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HISTORICAL AND PROFESSIONAL NOTES ON THE NAVAL CAMPAIGN OF MANILA BAY IN 1898.

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The naval campaign of 1898 in the Philippines has only one defect when considered from the professional point of view. The contest was too short and simple to develop many technical novelties or to solve many problems of attack and defense. Yet the immediate results of Admiral Dewey's advance were so numerous and striking that the campaign deserves careful study. Between midnight and noon on May 1 our squadron forced an entrance guarded by a chain of barrier forts and by lines of torpedoes, destroyed a formidable naval squadron, and established a safe and convenient naval base in hostile territory. The same blow destroyed the commercial activity and the political supremacy of the capital of the Archipelago. Before darkness fell on that day's work the Captain-General of the Philippines had acknowledged that Manila lay at the mercy of the American Admiral. Without attempting to show the historical or political significance of these events, certain strategic conditions and tactical methods may be presented for discussion.

The President's order following the outbreak of war made the Philippine Islands our theater of operations and the Spanish squadron our immediate objective. The security of American commerce demanded the prompt destruction of the enemy's cruisers, and nothing less would serve to quiet disturbances of public opinion along the Pacific Coast of the United States. Conquest might wait, but Spanish ships could not be left at large to prey upon the carrying trade and to threaten our unfortified harbors. Of course naval officers generally were aware that the Spanish fleet was condemned to a short radius of action and incapable of enterprises oversea. It was also known in Hong Kong that the political situation of the Philippines made the revival of native insurrection an inevitable sequel of American aggression. This prospect helped to solve the problem of finding the Spanish squadron and relieved our chief anxiety.

It should not be forgotten that the first act of war in the Philippines was the capture of the ship Saranac near Iloilo on April 26. The Spaniards were eager to boast of their prize and fancied that our fleet must be crippled by the loss of her cargo of Australian coal. Fortunately, other arrangements had been made and, moreover, it turned out that the vessel was duly equipped with papers showing a transfer to the British flag, so the local authorities had to release her. As they meant to use like expedients for the salvation of their own steamers, their scruples were not unnatural. Curiously enough, this was the only attempt to seize a mercantile prize made by either side during the war in the Far East.

Meanwhile, the American cruisers had been forced to quit Hong Kong and were accused by Manila journals of "hiding their flag," and of wasting coal and hoarding ammunition. There had been some concern about docking and coaling the Baltimore within the limits of neutrality, but the subsequent delay had no other object than to await final instructions from Washington and the arrival of our consul from Manila. It was thought that he might bring some valuable information, but the operations which followed did not depend upon vague rumors and crude calculations gathered in the enemy's capital. Neither the number nor the location of the Spanish squadron of defense was known until the vessels were actually sighted, nor was any valid account of the shore batteries in the hands of Admiral Dewey

when he steamed into the bay. As for the submarine defenses of Manila, they must remain an unfathomed mystery to the end of time.

The real problem was that of finding the enemy's ships. However defective they might be in offensive power and in mobility, they had their choice of a dozen harbors within a day's run of their naval base. The natural sortie harbor for the strategic defense of Manila Bay was obviously to be found in Subig Bay, about sixty miles northwest from Cavite. A fleet installed in this harbor would threaten an invader's lines of communication and compel him to keep his forces concentrated, thus limiting his activities in blockade and reconnoissance as well as in bombardment and the landing of troops. We knew that the strategic advantages and nautical convenience of Subig had been recognized by the location of a naval arsenal at Olongapo, and that a naval commission had been engaged for a dozen years in elaborating plans for the industrial and military equipment of this excellent harbor. Of the concrete results we had no definite information.

Yet it seemed that some measures of defense must have been executed before our arrival. There had been months of warning preceded by years of discussion. The natural conditions favored defense. The main channel was only a mile wide and it was commanded by numerous sites for batteries and barrier forts on Isla Grande and on the wooded bluffs along the western shores. This channel was rather deep for mooring mines and no confidence was placed in those which had been anchored in the entrance. For naval defense the position was admirable, as a curved line of vessels three miles long could deploy in deep water to envelop the heads of columns of attack and check their advance by concentrated fire. Such considerations induced Admiral Montojo to abandon Manila and Cavite on April 24, but his squadron was soon discouraged and hurried back to the miserable station under the guns of Sangley Point. The reasons for this hopeless retrograde movement are officially stated as follows: some ships proved unseaworthy, the Castilla leaking until her shaft-alley was packed with cement; the Ulloa was unable to leave Cavite and the Velasco unfit to join even a stationary line of battle; then, the excellent guns provided for the Isla Grande batteries were still unmounted after six weeks of baffling delay;

finally, the water was too deep, and lives as well as ships would be sacrificed at Subig. This amazing and unseamanlike notion seems to have had weight in a council of captains, and it appears to have leaked out to demoralize the crews, since we found it circulating among the Filipinos after we landed at Cavite.

When the scouting cruisers of our advance found this noble harbor unguarded we began to hope that the enemy might be found off Manila, although no nautical or strategical reason justified this expectation. Sentimental and political factors may explain concentration at the capital in spite of the superior advantages of Iloilo or any of the numerous harbors formed by straits separating islands and affording two or more channels of exit. Had one of these ports been held, the squadron would have retained freedom of action until the assailant felt strong enough to divide his forces and to deprive his detachments of mutual support. Since no port in the Archipelago was guarded by barrier forts, and since Spanish *torpedistas* could not trust their own work in submarine defenses, the squadron could only find security through strategic liberty and tactical vitality. Being unable to defend itself, no place could be found for it in the defensive scheme of open bays or uncovered towns.

Unless the combined batteries of ships and forts were trusted to beat off our attack on Manila, it was a strategic blunder to concentrate there. The capital was bound to be one of our objectives and the fleet another, and we might have been forced to make scattering reconnoissances involving risky tactics, random pilotage, and unprofitable expenditure of time and coal. Nothing but a superior defensive situation could justify the plan adopted, and Manila Bay afforded no such advantage. If any defense was in order the fight had to be made at the entrance, twenty-five miles from the city. As soon as the cliffs of Corregidor were passed the control of the bay and the protection of the city could be assured only by naval superiority. In obstructing the entrances by the Boca Grande and Boca Chica every form of defense might be made to co-operate, batteries ashore and afloat covering those weapons of the weak, torpedo-boats and submarine mines.

The American tactics of approach had been freely discussed before the fleet left Hong Kong. It had been proposed to attack in line abreast and to rely upon bow fire. The structure of many

armored vessels and the disposition of their batteries might seem to favor this formation, but the modern view prefers a flexible column moving briskly along the line of fire and enveloping the enemy by superior speed and extended order, so that his huddled groups might be shattered by concentrated fire. The enemy's defensive attitude and his misplaced reliance upon covering batteries on his flanks promised to localize his squadron and he was found in the exact position which had been most carefully studied and diagrammed on the chart. The Olympia, with her heaviest guns in turrets disposed for fore and aft fire and for the protection of the intermediate batteries in end-on attack, was the only ship fit for a line abreast. Even with her the broadside fire was much heavier than that on the bows and, as three years of target practice had shown, her five-inch battery was as much superior to her turret guns in accuracy and endurance as it was in rapidity of fire. High authority had attempted to convince the division officers that eight-inch guns in similar turrets had been fired with good results at intervals of one minute. Investigation showed that loading and sponging required nearly two minutes and that pointing might impose many seconds of delay, especially at stationary practice. Better breech-blocks, more rigid shafting for sighting the guns, telescopes covering a four-times larger field of vision, and improved dry batteries for firing had greatly improved the operation of these turrets during the cruise, while division officers and engineers had been indefatigable in adjusting valves of the steam training-gear, and jolting had been nearly eliminated from the rotary motion of the turrets. Nor were the hydraulic cylinders scored by the pistons, nor the buffers jammed in ramming out, on this memorable occasion. Of the familiar drawbacks of target practice the smoking of telescope lenses was the most inveterate. The difficulty of finding the target, due to obscured and contracted outlook, may serve to explain the depressing fact that these guns, handled by well-trained crews directed by attentive officers, fired less than half as many shells as the Baltimore's similar battery mounted on old-fashioned carriages on bow and quarter. The Boston's pair in barbettes also beat the Olympia's four in turrets, in spite of vexatious delays caused by crippled locks. But the five-inch rapid-fire battery redeemed the situation by firing as many shells per gun during the hottest action as the two turrets were able to expend in a much longer

period. There was a natural tendency to favor the heavier guns by maneuvering and by employing them at longer ranges. But the range-tables fail to justify this preference, and there was no obstacle to requiring the full penetration of even a five-inch shell.

Having decided upon an advance in column and the use of broadside fire, the line had to be lengthened to include the two purchased colliers and the unprotected revenue cutter, Hugh McCulloch. At sea these vessels had formed a second column parallel to the six cruisers. Darkness was preferred for running past the batteries at the entrance and the night was a favorable one. The moon was masked by light rain-clouds during the first watch, but the horizon line was always clear enough for safe navigation. The commerce of Manila mostly enters by the *Boca Chica*, or northern channel, because it is more convenient for the quarantine inspection from the station at Mariveles. Force has been used to compel ships to use this narrow entrance when the wider channel would have been more convenient, and myths concerning dangers to navigation in the *Boca Grande* have been circulated. None of these dangers are shown on the chart, and the honored name of Sir Edward Belcher guarantees the boldness of the water throughout the broader channel and about El Fraile in particular.

It was known that batteries had been installed on Corregidor Island and it was uncertain if there were any on the mainland on either side. There were reasons for mounting the guns well up the slopes of this island. Had they been near the summit, 600 feet above the water, they would have commanded both channels and been quite inaccessible to projectiles from modern rifled guns, except at ranges greater than three miles. At shorter distances there would have been no angle of fall to land shells within gun-pits or parapets. This consideration seemed to close the northern channel and drew our line three and one-half miles south of the central island and therefore within half a mile of the isolated rock El Fraile. This mass has little more bulk than the Olympia or Baltimore, and the latter often raised a vast pillar of cloud when her fires were cleaned. It is inconceivable that our line should have passed unseen had any lookout been kept along the shores. It was known that we were off Cape Bolinao at dawn and off Subig at 4 P. M. of April 30. The Commandant of Corregidor had appealed wildly and in vain for two gunboats to

patrol the channels. One vessel lay near Mariveles and her signal lights were twinkling as we stood in. They were answered by a rocket from the summit of Corregidor, yet there was no firing until the Olympia had passed the narrows and entered the open waters of Manila Bay. Then the swing of her stern light, as she headed up five points, startled the gunners on El Fraile and drew their ineffectual fire. Shells whistled through the gaps in our column and drew a brisk fire from the Raleigh, Boston and Concord. Even the McCulloch fired her six-pounders. Some of our shells were seen to burst and the enemy's batteries soon fell silent.

Long afterward we learned that three batteries had been placed to command the Boca Grande while four guarded the Boca Chica. The Fraile battery was equipped with excellent breech-loading rifles, but its location seems absurd. The rock could have been surrounded and taken in rear; its guns were mounted with small train and had little stability; guns and their crews might have been buried by splinters from the rock which overhung them. Nature had separated the available sites too widely for co-operative effect upon an enemy maneuvering freely in open waters and in dispersed order. The defensive scheme was a weak improvisation, but abundance of resources and time would not have availed to make these approaches secure.

Much has been said of mine-fields in this channel. It was "full of torpedoes," according to Don Enrique Sostoa, Commandant of the Naval Arsenal at Cavite, and the Captain-General. The lines of torpedoes were all in place and the batteries ready to open fire on the night of April 27, according to Señor Garces, Colonel of Marine Artillery. But all the dispatches relating to torpedo defense indicate confusion and uncertainty. There was no gun-cotton and not enough pebble-powder; blasting-powder was demanded, along with insulating materials of all sorts. But depths of 30 fathoms in a channel five miles wide render this method of defense uncertain at the best. Under Spanish control the mines would be apt to go adrift, and they would certainly impair the morale of any fleet drawn up in rear of their lines. Countermining would have been easy had our ships been equipped therefor or our officers instructed in that essential art, which seems to have received little recognition in our technical schools. But no floating torpedo was ever discovered in Manila

Bay, nor was any search made, in spite of the amiable warnings of the naval authorities—warnings transmitted after the "withdrawal of the Spanish fleet" on the first of May.

As soon as our ships were clear of the danger space in the channels of entrance they commanded the bay with excellent anchorages anywhere within a circumference of sixty miles. This security led to some talk of clearing ship for action by getting rid of the boats. The Olympia had a dozen big wooden boats inconveniently arranged on cradles, requiring two hours' work of the ship's company, unassisted by steam winches, to launch them overboard. The other ships had their boats swung at davits and might have lowered them in a few minutes. Of course the danger from fire and splinters was recognized, but it was not convenient to do the work after dusk and the sighting of the Spanish fleet at dawn disposed of any notion of precautionary delays. Yet it must be held as a wonder that no damage was done to the boats by the enemy's fire and that our own fire was unobstructed by flames or fragments from these boats. Those carried outboard were generally wrecked by concussion, so that the Olympia had the advantage for this exceptional occasion.

The consular rumor had reduced the Spanish fleet to two vessels, one of them partly dismantled, and had led us to look for them near the breakwater in front of Manila. Our course was shaped to verify this strange report and Cavite was not reconnoitered in approaching from the westward. At five o'clock we were three miles west of the mouth of the river which divides Manila. Sixteen merchantmen were counted; no steamers, no cruisers, lay off the city. Not many minutes later the Spanish line was made out, stretching to the eastward of Sangley Point in front of the white buildings of the arsenal. Standing to the southward, parallel to the shore, the Olympia brought the enemy well on the starboard bow and our six cruisers stretched along in her wake, the colliers and the McCulloch being sent to the middle of the bay. No attempt was made to count the enemy's force or to identify individual vessels. Our own line was miscounted and the Helena was added to the list in the report of the Spanish Admiral. There was no occasion for close comparisons; general information served to convince us that our six cruisers could defeat all the vessels that Spain had in the Philippines, es-

pecially if they chose to lie massed and motionless within easy range of open waters deep enough for safe navigation. There were seven of them in line, as it turned out; two of them, the Castilla and Don Antonio de Ulloa, were moored with springs on their cables. The others steamed about in an aimless fashion, often masking their comrades' fire, occasionally dodging back to the shelter of the arsenal and now and then making isolated and ineffectual rushes in advance—rushes which had no rational significance except as demonstrations of the point of honor. They were mere flourishes of desperation inspired by defeat.

The Spanish ships were ready: they were cleared for action, and their crews animated by rounds of regulation cheers and the display of battle-flags, before the action began. The first shell came from Sangley Point and fell short by a mile or so. Extreme range was then tried and the shell splashed ineffectually, more than six miles away. These wild shots steadied our nerves, though the crews of the anchored merchantmen and the dwellers in the northern suburbs of Manila must have been startled by the projectiles fired across our track. One of the five 15-cm. breech-loaders on Sangley Point resented the strains of extreme elevation and broke loose from its mount with its sight set at 10,500 meters. As our line extended in front of the gray walls and white houses of Manila we were saluted by the roar of big guns from three principal batteries, which included four breech-loaders of 24-cm. caliber firing heavier projectiles than any guns in our squadron. Two of these batteries had the walled city as a background, while the third lay some 1500 yards to the southward on the borders of the Luneta promenade or execution ground, and the neat suburb of Malate. The leading ships disregarded this impertinent attack, but the Concord sent some shells close enough for a warning. The firing of these guns deprived the city of any right to protest against immediate bombardment. They continued to waste ammunition for some five hours, and the chief of artillery shot himself that evening to expiate his failure and his disobedience of orders, committed under the stress of an impracticable code of military honor laid down in obsolete regulations.

None of this random cannonading distracted our attention from the ships, and we soon saw them masked in clouds of white smoke. Our line of advance was beaconed by columns of spray

where the shells sank or soared in erratic *ricochets*. The absolute inefficiency of all projectiles which fall short was to have abundant demonstration that day. The fire grew faster as we ran down our distance. When the range was estimated at 5500 yards the quiet consent of the commander-in-chief released the tension and the Olympia was jarred by the shock of one of the eight-inch guns in her forward turret. This shot was fired on the starboard bow and the ship did not swing to bring her port battery into play until she was within 4000 yards of the eastern ships in the Spanish line. Then the five-inch and six-pound guns poured in their rapid fire and the rest of our line turned and opened with their broadside batteries in due succession. Our shells rained all about the huddled enemy and many eyes watched eagerly and ineffectually for direct evidence that a due proportion of them were finding their billets.

Just as our line got fairly engaged a distracting element appeared. A small steam launch with awnings spread and a big Spanish ensign streaming astern, advanced from the cove behind Sangley Point, crossed the bows of the Olympia and then turned toward the shore as if to lie in wait for that formidable antagonist. There could be but one interpretation of this movement: this was a torpedo-boat, and she had to be treated as such. Secondary batteries began to pick up the range and their shells were soon veiling the target in spray and smoke. A few rounds were fired from even the main batteries, while the marines did all that may be accomplished with Springfields at 1200 yards range. Yet the reckless craft still floated, though no longer able to steam or disposed to use any weapon. She drifted ashore under the guns at Sangley Point, where she continued to draw fire from the six-pounders, in spite of keen remonstrance from high authorities, until the action was over.

It seems proved that the launch was no deadly microbe, but only a humble market-boat, manned by Filipinos and bound to Manila by direction of the English family residing at Cañacao. The literal oriental manner of executing domestic routine amid the shock and thunder of battle eliminates the heroic from an action of amazing rashness. But the moral of this incident is all on the side of genuine torpedo-boats. Here was a conspicuous craft slowly executing the traditional maneuvers of torpedo attack and awaiting the advance of a squadron not undistinguished

in the annals of naval gunnery—a squadron which surpassed its enemy by a score of 100 to one. Yet the frail hull was not shattered, nor the boilers exploded. Even the crew escaped with their lives, though a shot had pierced the steam cylinder. The boat was repaired and fitted to carry generals by the time that American troops appeared on the scene.

After reducing this alarm to its lowest terms it becomes necessary to strike out all rumors of a second mythical torpedo-boat. No responsible witness has been found to locate or describe this apparition, although some fell into the natural error of duplicating the legend. Perhaps the erasing angel should also blot out the report of submarine mines exploded ahead of the Olympia before the ships opened fire. Such an explosion, miles ahead of our advance, could indicate nothing but panic. Against the testimony of many sincere eye-witnesses stands the statement of Captain Concha, commanding the Don Juan de Austria up to May 1. This intelligent and disinterested observer denies the existence of any submarine mines or the presence of any improvised torpedo-boat off Cavite. This statement leaves some of us face to face with illusions of vision or memory. One launch, the España, was more or less equipped with torpedoes in April, but she seems to have sought safety in some river to the northward of Manila, where the natives found her sunken wreck during the summer. Had there been half a dozen real torpedo-boats in Manila Bay in the hands of fearless and skilled officers the whole situation would have been transformed, and a defensive system of anchorages and patrols would have imposed constant strain and vast expenditure of coal and ammunition, with the probable loss of one or more ships to complete the account.

The pilotage of the American fleet through the channels of entrance and up the bay was a simple matter, in spite of the extinction of the five lights upon which navigators are accustomed to rely. Safe navigation during the action was a more delicate business. Cavite Bay is well surveyed and charted on a convenient scale, but grave doubts were attached to the soundings by notes in the Sailing Directions and on the chart. This reproach turned out to be unmerited, but a certain degree of caution was imposed thereby. The orders of the commander-in-chief required the Olympia, drawing 24 feet, to keep outside the five-fathom curve as laid down on the chart. As none of the other

ships drew as much as the flagship they had only to follow and turn in her wake, which was curiously distinct, both by night and by day, in the oily smoothness of the bay. A careful quartermaster gave the soundings from the off-shore side and the ship's position was plotted from cross-bearings taken by the standard compass at frequent intervals. Growing familiarity with the soundings showed depths nearly a fathom greater than those marked on the chart during the morning tide of May 1, though proper reductions confirmed the printed record for the neighborhood of Cavite.

The Spanish line stretched nearly east and west inside of Sangley Point, while the five-fathom curve bent to the southward of west. Therefore, in running to the westward our column tended to converge toward the batteries. In fact, we turned off the point within 1500 yards of those guns which we had noted as ranging six miles. Once we were within 1200 yards, but hardly a hit was made, even when we turned in overlapping groups, presenting a huge gray mass as a target. Had the skill of the gunner who hulled the Baltimore with an armor-piercing shell been general among his comrades this might have been a rash maneuver. Of course, it was always open to us to pass at speed and turn out of range of the batteries ashore and afloat, as we did on the eastward runs. Had each transit across the firing arc begun with the column formed and intervals closed, the broadsides would have been more rapidly effective. Contempt for the incompetence of Spanish gunners justified in practice some departure from ordinary rules of prudence. Besides the boats on cradles or swung at davits there were other instances of manifest exposure, since the Olympia was steered from a wooden pilot-house on a wooden bridge covered by screens of painted canvas, and the shafting of the hydraulic steering-gear was not safe while thus connected. Captain Gridley found himself in close touch with the battery and engines while stationed in the conning-tower, and he could have conned the ship from that station with the assistance of an officer at the standard compass, though the bridge arrangement was a trifle handier. Obviously, these notes have no value or significance except with reference to future contests.

While our column kept sweeping along the five-fathom curve the question of ranges was settled by the navigation. The Span-

ish fleet received our fire from something less than 4000 yards in the eastern approach and the firing ceased at less than 2000 yards as we passed behind Sangley Point. The average distance was about 2500 yards, and no range could have been better adapted to the conditions. Six-pounders were thoroughly effective and five-inch shells could penetrate any obstacle offered by the structure of the enemy's ships. Shortening the range at an early stage of the fight might have invited injury to our ships as well as loss of life. The usual methods of range-finding were as baffling as ever; the only electric range-finder failed after the first round; the stadimeter or sextant could not be used without more knowledge of masthead angles than was available, especially as topmasts were generally housed. It was always easy to determine our own position, but the enemy's was never accurately marked on the chart. The Olympia's reckoning placed it too far inshore, and, therefore, gave ranges in excess by 200 yards or more, yet many of her shots were noted as falling short, and the ranges used in some other ships seem to have been greater throughout the action. No one in the Olympia was gifted with the vision required to mark the fall of rapid-fire projectiles, and an equal uncertainty attaches to all her eight-inch shells except one which was officially recorded as striking the stern of the Reina Cristina. Under these conditions range-finding by the secondary battery was illusory at Manila, as Lieut. Hill demonstrates it was off Santiago.

Our movement across the line of fire assisted in drawing each ship clear of her own smoke and the intervals of 400 yards allowed each cloud-bank to be dissipated before fouling the next ship in line. Still this escape was only relative, and there was much residual annoyance. The telescopic sights of the turret guns required incessant wiping and the rate of fire was much reduced by their dimness. Smokeless powder offers a remedy, but the variety used by us on August 13 substituted red smoke for white without much reduction in density. That day's work demonstrated the drawbacks of stationary practice, even with improved powder. The advance of the ship also assists lateral pointing, as the motion is steadier than that given by the rotating gear, which involves too many shocks and surges, especially when hundreds of tons of turret armor have to be revolved by steam.

Our diagonal advance also served to disconcert the aim of our unskilled opponents, as they lack sliding leaves for correcting the aim. One captain has told us that he told his men to fire at the stem of the Olympia during her passage. This calculation seems to promise an occasional hit, but none were counted. The elevations were, perhaps, even more difficult; we have little reason to think that any measurements were attempted, although a correct memorandum of the heights of the Olympia's funnels and superstructure was found at the arsenal. The batteries at Manila had wooden azimuth circles and telephones which should have enabled them to plot our tracks; they had nearly five hours practice, but no amount of deliberation or persistence enabled them to score, even while we were drifting about, with crews at breakfast, within the radius of their fire. Altogether, there is little to be learned from a study of Spanish methods or theories of gunnery.

Of the enemy's tactical disposition it is impossible to speak with more favor. Since the ships could not maneuver and there was too much risk in fighting in deep water, a place of refuge was what they had to seek. This could only be found where the front could be covered with mine fields and the flanks guarded by batteries or shoals. Manifestly, the distance of five miles separating Sangley Point from Manila was too great for combined effect of shore batteries or for obstruction by fixed torpedoes. Yet the line selected was a section of this long curve, and it was thrown so far to the northward that we were able to steam along a nearly parallel line in deep water and without changes of course at the most effective range of 2500 yards. This practically made the affair a duel between two squadrons, with the stronger at liberty to utilize every element of superiority. The American ships might even have refused close action with the battery on Sangley Point without neglecting the eastern end of the Spanish line. A resolute scheme of defense might have made Sangley Point the key of the whole situation by covering it with earthworks and mounting all the best guns from the useless walls of Manila, distributed for large arcs of fire. Our experience in silencing such batteries was not encouraging, and the task would have been harder had the enemy's fire been rapid and occasionally effective. Had this flank been guarded, the line could have drawn backward toward the arsenal and the village of

Bacoor, with each ship in the shallowest water suitable for her draught. This would have compelled us to advance in line, feeling our way by the lead and fretting about torpedoes. Our larger ships would have been forced to engage the shore batteries while those of lighter draught stood into the bay. The spirited guidance of the flagship depended upon actual leading and could not have been maintained by signalling, and fleet evolutions would have been impracticable. After advancing bows on until entering the arc of punishment—and surely there must have been such a space somewhere under the Spanish guns—each ship might have to turn, under every moral and material disadvantage, to withdraw to a position where marksmanship would recover its value.

This plan requires no material resource not actually available at Manila. A dozen serviceable breech-loaders and nine rifled mortars lay along the walls of that city, and there was enough torpedo material to make these shallow waters dangerous for a season. Possibly there was some lack of co-operation between army and navy in defense; possibly some futile political notion tied the guns to the absurd water batteries of the capital. Perhaps it was realized that defeat was inevitable, and everybody was engrossed with the salvation of his military honor without regard for concrete results. Tactical defeat was inevitable if the battle was to be fought out in Manila Bay, but a few lucky shots might have checked the invasion or inflicted injuries compelling temporary withdrawal and strategic defeat. Arbitrary rules of military honor and futile chances of individual heroism are as nothing compared with rational and resolute plans for enduring to the end. But Spanish history is written in another sense. "To breed men and waste them" is the awful tradition of the ancient Kingdom of Castile.

Animated by desperate counsels, Spanish vessels had made one or two attempts to advance to meet us in front of their line. Only one of these efforts was persistent or significant enough to be remembered. As we stood to the eastward on our third passage along the zone of fire the Reina Cristina, bearing the flag of Admiral Montojo, was seen to detach herself from her consorts and to approach a gap in the line with the apparent purpose of coming to close quarters with the Olympia, which had just changed her course sixty degrees to the southward of her pre-

vious tracks toward the turning point. The two flagships seemed closing rapidly, but the Spaniard had only advanced a ship's length or so beyond his line before his progress was arrested by a hail of concentrated fire which produced immediate and visible results. His speed slackened; smoke puffed out forward and aft; a white plume of escaping steam showed that his motive power was crippled, and an awkward turn, exposing the unprotected stern, suggested that his steering-gear had met the same fate. The beaten flagship crept toward the arsenal, where she grounded, burned and blew up during the morning. We all saw that she was disabled, but it required some hours to demonstrate her destruction.

Hitherto there had been much disappointment among those who tried to observe the effect of our fire. Some of the gunboats had seemed to flinch and had dodged in and out near the arsenal. The white bulwarks of the Castilla had been scarred and blackened by our fire, but even her wooden hull had not burst into flames after two hours of brisk bombardment. Annoyed by this delay in destruction the commander-in-chief had decided to try the effect of stationary practice. The signal was made to prepare to anchor; the Petrel was warned to detach herself for turning the eastern end of the Spanish line. The station selected for the Olympia lay well inside the five-fathom curve and within 2000 yards of the center of the enemy's position. The course had been changed to southeast when the Cristina's advance was noted. Since she had to be met underway the signals were annulled. Anxiety in regard to the swinging of the ship when anchored was thus removed; it was a case for applying the maxim, "Ef know wind and know tide, know telling," written by an aspiring but unliterary mariner during the present year of grace. Doubtless the time for closing and finishing with the enemy was at hand, but the experiences of target-practice, supplemented by that of this action, fail to show that any advantage would result from anchoring. Twin screws enable vessels to be pointed as well as to be held fast in their stations. But the circling movement in column had not failed in practice and might have been continued until resistance was crushed. In fact, one more turn was made and our ships passed to the westward of Sangley Point in unchanged order.

It has been assumed by remote interpreters of the lessons of

this contest that the Spanish fire was promptly silenced or smothered by the superiority of our broadsides. There was a visible falling-off in the rapidity of the enemy's shooting, but, judging from our own experience, we attributed this to the expenditure of accumulated stores of ammunition—our decks were soon cleaned of great mounds of rapid-fire shells—and to the obstructive effects of smoke. In accuracy the Spanish gunners had neither gained nor lost; they could drop shells close alongside or they could send them soaring aloft. But each ship seemed to carry its own charmed circle—not always of large circumference either, since one seemed to count a hundred shells within a ship's length during the two hours of actual combat. Of course, these shells, which burst before our eyes, scattered radial showers of fragments which cut rigging and scored spars, and there is a record of some half a dozen actual hits, though nothing larger than a six-pounder accomplished both penetration and explosion. But the fact remains that the enemy was not silenced after two hours' work, and that none of his ships were structurally destroyed or obviously disabled during the period when our fire was returned.

Since there has been so much public discussion of the motive for hauling off to the northward and discontinuing our fire at 7.30 A. M., it may be well to submit a reconciling statement to harmonize popular notions with official records. We did not stop fighting because our men were hungry, and there was no shortage of ammunition. Nevertheless, some 1700 Americans did eat a hearty, though scrambling, breakfast during the next hour. The last meal seemed to belong to a different historic epoch, although the Olympia's people had had lukewarm coffee at four o'clock. Some ships' companies had missed even that unsatisfying refreshment. Few were glad to stop fighting, even for the sake of food, but all had a general sense of victory, though details remained questionable and the enemy's flag was still aloft when we ceased firing. It is true that there was some concern over the state of our ammunition rooms until the task of restowing and counting was completed. The weak point in the Olympia was the supply of shell for her ten five-inch rapid-fire guns. These splendid weapons had consumed 350 shells in two hours—nearly forty per cent. of the original supply. But a mere verbal misunderstanding had carried a more depressed account

to those in authority, and the resulting inquiry consumed time and interrupted the battle. The eight-inch guns could hardly have expended their projectiles in a week's fighting and the six-pounders were equally overstocked. The Bureau of Ordnance had sent out new stocks of ammunition by the Baltimore, arriving in Hong Kong just in time for distribution among the vessels in the fleet, and further supplies were promptly dispatched in the Charleston and the City of Peking. A revision of allowance tables, giving due recognition to the demands of the rapid-fire guns of main batteries in preference to the slower armament of the turrets, is the only amendment suggested by this test.

The shock of two hours' incessant firing served to deafen many people—especially those who stood on the planking of the bridges. Within the conning-tower and aloft on the grating above it, where the commander-in-chief took his station, this jarring effect was not felt. But it required much energy and emphasis to con the ship and to pass orders to the batteries by word of mouth. Telephones were out of the question and voice tubes uncertain. Even the articulation of many files of marines did not prevent occasional confusion. A system of dials for indicating ranges should be installed as soon as electrical science is ready to equip them. The impression produced by visual indications is far less fugitive and uncertain than those depending upon hearing. Considerable signalling by the navy code was carried on during the action, but the flagship's example was far more impressive than any secondary method of control. Signals were not always made out—or, at least, not always answered with promptness, and the appeal to "close up" was frequently and effectively displayed. Tactical movements in column seem practically independent of exactness in signalling.

Before the hostile squadrons separated the Spanish ships had visibly suffered from fire, especially the Cristina and Castilla. The latter was the only wooden vessel engaged, but all the others, including the American cruisers, were full of inflammable material. Two curious fancies relating to fires seem to have attacked the imagination of Spanish journalists; they alleged that their ships were all of wood dried to tinder by tropical heat, forgetting the dampness of the Philippine climate; then came the fancy that we used incendiary projectiles forbidden by all laws, human and divine. Our shells were to be scraped and their coat-

ing analyzed for conviction on this charge. A complete demonstration of the incendiary effects of even the smallest rapid-fire shell was given when the Chinese squadron was destroyed in the Min River in 1885. Our experiment was really much less striking; many shells burst in wood-lined spaces with amazing effect in producing splinters but without combustion. This seems to have been the case in the commandant's house at Cavite Arsenal as well as in the ward-room of the Boston, where a six-pound shell shattered furniture and smoked an officer's clothing without appreciable scorching effect.

Of the other elements which make batteries efficient let us first consider the accuracy and rapidity of fire. It is well to avoid dogmatizing over comparisons or basing technical assertions upon sentimental data. In accordance with familiar and obvious principles of naval gunnery we find that the number of fires and the percentage of hits diminish as calibers increase. Rapid-fire ammunition and improved mechanism are apt to justify themselves. The rotation of armor is a costly burden in pointing and gun-captains aim better when they are not shut up in turrets with peep-holes and telescopes obscured by smoke. Finally, we must allow their full moral value to these prime requisites of accuracy and rapidity, since they alone may defeat a squadron before any of its ships are structurally injured, and may silence batteries before a single gun is dismounted. The other elements of battery power, penetration and explosive effect remain secondary to the accuracy, upon which all effects depend. Since no floating target was found impregnable to the five-inch breech-loaders, the smallest guns in our main batteries, we may not dispute the figures of our range-tables. The rumor which assigns overwhelming effects to the explosion of eight-inch shells relates chiefly to the production of flame and smoke. In closed spaces and among inflammable material these effects are appalling but hardly disproportionate. The perfect fuze is a thing of the future, since a shell may penetrate an iron ship from side to side, even carrying away the heel of an iron cathead without exploding, while a similar projectile may only blow out a shallow cup-like crater when striking antique masonry.

No pains taken in collecting stale rumors and inspecting sunken wrecks can give us the number of hits made or enable us to estimate the accuracy or explosive force of our projectiles. Ad-

miral Montojo talked of seventy hits in the hull and superstructure of the Cristina. The latest inquest shows hardly half that number. If one had to guess at the percentage of hits to shots aimed at this unhappy flagship, five per cent. would be as neat a figure as any other. The best estimate of her loss was fifty-three killed and one hundred wounded. The numbers given by a Filipino oiler whose gossip seems gifted with recurrent vitality are obviously mythical; thus, he uses 365 too readily; he even introduced that suspicious figure when the official complement is doubled thereby. Admiral Montojo uses figures close to those of the Navy Register and gives an aggregate of 1875 men afloat, a number considerably in excess of the force under Admiral Dewey's command. In spite of occasional historic doubts it may be asserted that the Spanish total complement is meant to include the complement of officers designated for each ship.

During the hours devoted to refreshment, to counting ammunition and to consultation, the Spanish line was seen melting away; the Castilla in flames, the Reina Cristina blowing up as her magazines kindled, and the smaller vessels taking refuge behind the arsenal. Only the Don Juan de Ulloa kept her ensign flying and maintained her station close to the battery on Sangley Point. Two guns from this earthwork and two 24-cm. guns from the battery on the Luneta south of the bastions of Manila still roared ineffectually at intervals. Four or five miles north of Sangley Point engines were stopped and our cruisers gathered in irregular groups, which continued to draw the enemy's fire. Now and then a shell splashed within a few hundred feet of one ship or another, but these demonstrations had lost interest. When we first found ourselves in range of the batteries at the entrance only twelve hours before, every nerve was strained and every gun was ready to answer the enemy's fire. Now we could wait while our crews finished breakfast and cheered themselves hoarse when comrades passed within hail or the enemy's ships exploded.

Uncertainty as to the enemy's condition and anxiety about the supply of ammunition served to obscure the magnificent completeness of our victory. Blockade was the next step of belligerent action, and the question was raised whether that operation could not be more safely conducted from the port of Mariveles, at the entrance of the bay and twenty-five miles below Manila.

Fortunately, it was soon made plain that only a shattered remnant could oppose our absolute occupation of the whole bay, including the use of the resources of the arsenal and abundant opportunities for purchasing supplies from friendly natives. The gunboats still remaining might have annoyed us by torpedo attacks had not our work been completed and the moral results of conquest driven home by a triumphant demonstration in front of Manila. Therefore the commander-in-chief ordered the attack to be renewed at 10.30 and the column headed to the southward.

Lingering concern for the supply of ammunition imposed restrictions on the Olympia's five-inch battery and the Baltimore was designated to lead the advance. Approaching Sangley Point with a considerable lead she turned her broadside on the battery and sent her shells into the sand-pit, where their explosion opened vast craters and drove volcanic showers of gravel about the gunners. The Olympia followed, using her six-pounders effectively at 1800 yards range. As the Baltimore lay motionless the column was led past her, each ship firing when clear and cheering during the intervals. The Spaniards could not stand to their guns and were seen to run away, using an ambulance in their flight. They had, perhaps, fired half a dozen shots during the famous "second action." The Ulloa also had a gun's crew on board and fired two or three times. Then she was sunk by sheer weight of metal, by the concentrated fire of the Baltimore, Boston and Raleigh.

The Raleigh aimed a few shells at the arsenal. Several buildings were penetrated but none of them were shattered, and fires were kept under control. Still, a score of men were slain by fragments, and after an explosion had shattered the furniture in an upper room of the commandant's house, a white sheet was flown from the cupola of that building. A few minutes later the Spanish ensign fluttered down from the lofty sheers. The navy yard was captured, along with some 2000 prisoners, including soldiers of the garrison and sailors of the fleet who had fled from their crippled vessels. We were free to take possession or to destroy. At first destruction was preferred, and the Petrel was sent in behind the arsenal point to complete the work begun by the Spanish crews when they were driven out of their ships. They had opened valves and cut pipes to sink the vessels, but the water was shallow and the upper works remained accessible to the fires

kindled by our boarding parties. In spite of both forms of destruction three of the enemy's cruisers, Isla de Cuba, Isla de Luzon and Don Juan de Austria, were rescued and sent to Hong Kong under their own steam, the hulls and engines being found reasonably sound and fit for repair. As we cannot suppose that Spanish officers welcomed the resurrection of their ships, we should not be surprised that they avoided interfering with those engaged in doing damage to property which they had tried to destroy and had been compelled to surrender.

In another part of the bay a similar task was in progress. The Concord was hurried in toward Las Piñas to burn the steamer Isla de Mindanao, which had been run aground after the naval action was over. This large mail steamer had prolonged the Spanish line to the eastward. She had been called a transport and disregarded while fighting was going on, although some witnesses asserted that she fired a few shots. It is certain that she had guns aboard, but other testimony goes to prove that her battery was not mounted or fit for use. Her presence in the line is accounted for by the fact that she could not enter Pasig River and that her master shirked the responsibility of taking her to sea when our approach was announced on April 30. She had been engaged in transporting war material and is said to have towed the Castilla back from Subig. She was advertised to sail for Barcelona on May 7. She was set on fire by persistent shelling and was totally consumed with her cargo. Her fate raised some problems relating to marine insurance but furnished no work for American prize courts. No other mercantile prize of appreciable value came to hand during the campaign in the Philippines.

The transport steamer Manila was, however, rescued by the Petrel and saved for naval use, along with half a dozen tugs and launches of moderate value but of convenient size for employment as packet-boats. Ten days after the action a Spanish gunboat steamed up to Cavite and fell into the clutches of the blockade. She had been sent to seek relief for the military and penal colony at Puerto Princesa in Palawan Island, which was entirely dependent upon the capital. The interruption of traffic had brought the garrison to the verge of starvation and the commander of the Callao felt bound to pursue his voyage even after noting the extinction of the lights off the entrance. He fancied

that our squadron was firing a salute at 7.30 A. M. and then fell back on some theory of erratic target practice until a six-pound shot went through his awning. Then he surrendered and gave his parole. It was long believed that he was shot for this latter act—not for blundering into the bay without regard to rumors of war—but he was found to be at large when Manila was taken in August. A similar gunboat, the Leyte, came out of the Pampanga River in July, bringing about forty officers and a company of soldiers eager to escape from a district overrun by the insurrection. These voluntary prisoners were placed in the custody of the Tagalos whom they had sought to evade. They were afterward made prisoners on the same footing as the garrison of Manila, but other prisoners captured by American cruisers in Subig Bay were still held by native authorities up to April, 1899.

The business of the American fleet off Cavite was concluded during the afternoon and the ships moved up to a safe anchorage in front of Manila, where the batteries had at last fallen silent. The Governor-General had been warned by a message sent through the British Consulate that any further cannonade from these futile defenses would lead to the effective bombardment of the unprotected city which lay behind them. This stern warning, backed by a show of overwhelming force, made the authorities acknowledge their defeat and duly impressed the garrison. Not even a rifle-shot was fired at any vessel or boat of the Navy until August, although soundings and reconnoissances frequently led us within close range of batteries and pickets. Even when the fleet was actively engaged in forcing the surrender on August 13 the only vessel fired upon was the Callao, which had closed in to harass retreating columns of infantry. Yet the usual evasive reports were sent to the Spanish Government, announcing that we had not been fired upon since our ships "failed to come within range."

The most striking passage of the official reports sent to Madrid told how we "had been forced with heavy losses to change formations and to perform various evolutions." The single column was the only formation; recurrent broadsides the only evolution. The ground covered had been studied on the chart and probable lines of approach laid down before leaving Hong Kong. Nothing that the defense could do imposed any compulsion on our maneuvers. The plan as well as the guns was everywhere victorious.

French critics have ventured on a comparison of this action with the destruction of the Chinese squadron in the Min River in 1884. They point out that the French required only half an hour to accomplish the work which occupied the Americans more than two hours. But the operations cannot be thus compared. Admiral Courbet's ships took up selected positions within musket shot of the prospective enemy and waited until they were reinforced by an armored vessel and until the Chinese ships swung to the ebb tide and exposed their weakest points. Then the peace was broken and a tremendous fire of artillery assisted by torpedo-boats destroyed the Chinese squadron. Victory did not establish the French fleet in control of a safe inland anchorage commanding the enemy's capital; nor did it turn the defenses of the river entrance, which inflicted serious injury upon the French ships while withdrawing from their untenable position off the arsenal below Foochow. The fact that the French secured the advantage before the outbreak of hostilities removes this affair from the category of regular naval battles. Valuable lessons in ordnance were taught, but the tactical example is inadequate for comparison.

The battle of Lissa in 1886 has a more direct bearing on the case. The Austrian fleet found the Italian deployed for bombardment and unprepared for mutual support. Several fine ships were destroyed by ramming and by shells, but a large portion of the Italian division engaged was allowed to escape and a still more helpless squadron containing a number of sailing frigates was not even reconnoitered. The ram gained by this action a degree of credit which it has utterly failed to maintain, and the excessive development of bow fire and other defective tactical dispositions were thereby inaugurated.

The curious lack of persistence shown by the victor at Lissa also characterizes the most recent fleet action in the open sea—the battle off the Yalu in 1894. The Japanese admiral fought his ships wisely and won a brilliant victory over the inanimate squadron of the Chinese. His tactics demonstrate the value of extended order and of flexible formation in column as well as the capacity of cruisers and gunboats to fight in line of battle when rapid-fire and constant movement are the order of the day. These facts were the basis of Admiral Dewey's tactics in Manila Bay and they enabled him to finish his day's work with a complete and

crowning success, while the Japanese squadron hauled off and left a defeated remnant reduced to the last round of ammunition to escape into a fortified harbor whence months of toil were required to extricate them. Possibly the Japanese were also short of ammunition, or anxious and uncertain about its endurance.

Of Nelson's masterpieces the battles of the Nile and Copenhagen offer certain analogies to that in Manila Bay. Pilotage was a prime factor of tactics on both occasions and shore batteries planted to support the defense also had their influence. The advantages of steam and of high-powered guns have greatly transformed details and distances, but tactical principles endure. Nelson always sought to overmatch his antagonist by isolating detachments, and never meant his captains to engage as duellists irrespective of plans. At Manila it was the enemy's blundering disposition which annulled any effective combination of his abundant resources, but the glorious fact that our column fought as a fleet under the exact control of confident leadership gives this action a place among the sea-fights of history.

It may seem a paradox to many, but the first honor of this record was due to unflinching readiness to act in ignorance—ignorance of the enemy's batteries, of his mine fields, of the stations and even of the numbers of his fighting ships. All these things might have been ascertained at the cost of much time and coal, but the painful effort would have lowered the vitality of the fleet and weakened the moral power of our Government at home and abroad. Because these things were realized on board the Olympia, and because of a certain natural contempt and cheerful distrust of all Spanish military and industrial undertakings, Admiral Dewey led his squadron through guarded channels at midnight and arrayed them for battle at dawn.

The supreme trial of a naval commander comes when his consorts are crippled or sinking in the midst of battle, when his splintered decks are ablaze, and blood runs from the scuppers. Since this fate was not met and vanquished we may not claim the highest rank for this memorable contest. But surely there are many who must hold it a matter of pride that our ships escaped and our men's lives were spared. This fortunate immunity was not the result of fine-spun calculations. The battle was fought to win, with no purpose of shunning close encounter. The escape of 1700 American seamen during a struggle in which a shell for

every man afloat was aimed at their ships still presents a problem incapable of mathematical or mechanical solution. It must simply go on record as an amazing experience.

Spanish commentaries ascribe the control of the victorious ships to men protected by thick armor and "in impenetrable calm directing engines of death with instruments of precision." Of course, this notion involves all sorts of absurdities. Except the sight-bars of the guns, the compass was the only instrument used in the flagship, and that stood on a lofty perch over the forward turret, on a grating just wide enough for the Admiral and the observer engaged in taking bearings. This was an open air battle where the ship was conned by visible landmarks and the distances roughly measured by the simplest methods. Every ship was under the eye of the leader, and none detached themselves for those single-ship combats which have claimed too large a place in popular legend and even in professional ideals since the naval war of 1812. Each ship did her best with all the guns granted her by the Bureau of Ordnance; straight shooting was the only exploit worth mentioning, and no recording angel will ever rightly apportion the ragged scores of our gunners.

The immediate strategic results of this action were slowly grasped. It soon became apparent that ships could cruise or anchor where they pleased without regard to the remaining armaments of the enemy. The batteries at the entrance were cut off from support and might have been attacked in detail. Therefore they were promptly surrendered. The navy yard was also surrendered on May 2, the garrison of Cavite and the naval battalion formed from the ships' companies being allowed to march out with their arms and other portable property. They had the presumption to ask for safe conduct to Manila, although many of them were held in garrison at points which threatened our occupation of the Cavite peninsula through intrigues with the natives, if not through aggressive movements. The wounded and sick at the naval hospital at Cañacao, numbering some three hundred, were sent to Manila under flag of truce. The inconvenience of guarding prisoners on shore and of supplying them with provisions may account for this policy of release as well as for the subsequent plan of leaving prisoners in the custody of Filipino authorities.

A small marine guard was detailed to guard the navy yard a

day or so after the Spaniards withdrew. Working parties were sent ashore to disable the guns at Sangley Point, which was easily effected by exploding a ring of gun-cotton disks around the chase of each gun. The magazine was incidentally blown up during the operation. Much small-arm ammunition was dumped into the bay at Cavite, whence the Filipinos afterward recovered it and refilled the cartridges. Some of the smaller rapid-fire guns were recovered from the wrecks and the Manila and Callao were destined to bristle with an eccentric armament. Some of the larger guns were also recovered from the ships, but breech-blocks were lacking and rust and fire were allowed to do their work on the main batteries. The Filipinos were allowed to gather some weapons from the arsenal; perhaps a hundred serviceable rifles, a trivial pair of bronze howitzers and two or three old smooth-bore guns were the only important items—all abandoned by the Spaniards as not worth carrying away.

The public was induced to form a very low estimate of the vitality of the fleet and gloomy prophecies were spoken of "crippled ships in an enemy's harbor." Of course, the fact is that a fleet can stand anything but defeat, and that an enemy's harbor is quite as good as any other if the enemy's fleet is destroyed and his batteries silenced. Manila Bay has its disadvantages as a harbor and the Cavite arsenal is only a fourth-rate navy yard, but all the shelter and all the resources provided by nature and by the Spanish Government were available. There was no dry-dock, but there was a marine railway and fair range of machine shops and well-filled storehouses. The Navy Department hurried out liberal supplies in all departments and all reasonable repairs could have been effected in due season. Fortunately, no delays or repairs were required to maintain the fleet in a state of constant efficiency.

The presence of such a force reduced Spanish authority in the capital to a mere pretense and parade of dominion. The walled city could have been laid in ruins by a few hours' bombardment, the foolish batteries having demonstrated their incapacity to hinder. Admiral Dewey summarized the situation on May 7 by cabling to the Department that he could take Manila any day, but that 4000 infantry would be required to police such a city. The assertion may be ventured that no subsequent occurrence has impaired the soundness of this modest calculation. There were

moral and political factors which rendered the Spanish position untenable. At first it was thought that an inland position out of range of naval artillery might be fortified and garrisoned and the water-front abandoned to American attack. Secure occupation would have been impracticable had the Spanish garrison been able to follow this plan, but the smouldering fires of the great Filipino insurrection of 1896 interposed a fatal obstacle. Withdrawal from the city left the insurgents in possession and the country was ready to cut off supplies from the exterior.

The insurrection was not long in putting itself in motion. Random majors and captains hurried on board at all hours of the night to ask our intentions, to beg for supplies and to offer assistance. At first it seemed impossible to take these emissaries seriously; their notions lacked coherence; they could neither count their partisans nor their enemies. The villages nearest Cavite had formed guards for local protection and seemed incapable of organized or intelligent effort. The town of Cavite was ruthlessly pillaged by canoe-loads of natives from the towns of Bacoor, Imus and Cavite Viejo—towns which had seen rebellion suppressed in fire and blood during the preceding year. Natives chalked "Tagalog" on their doors and shut themselves up to escape the storm, while Spaniards fled to Manila, abandoning their homes to pillage. One Chinese millionaire hired a Filipino guard and saved his warehouse from plunder. He may have been spared because of the fate of his son, who was one of the first victims—because he was one of the wealthiest men in Cavite—when the Spanish fury of 1896 ran its course in that unhappy town. Three stragglers from English merchantmen lived at free quarters and pillaged houses and churches until the Filipinos found a leader and set up a revolutionary government.

The new era began when Emilio Aguinaldo landed from the McCulloch, which had brought him over from Hong Kong on May 19. Pillage ceased in Cavite and San Roque and a new crop of robust recruits, Tagalos from Cavite and Batangas provinces, were soon organized into ragged regiments and supplied with arms as fast as they came to hand. The small number of rifles left in the arsenal was only sufficient for guarding the peninsula of Cavite. For an advance toward Manila a larger force had to be equipped. Some thousands of rifles were purchased by the fund contributed by the Spanish Government to induce the

Filipino leaders to go to Hong Kong in January, 1898. A third source of supply was drawn upon before the month was over. Some thousands of Spanish prisoners were brought into Cavite, their arms going to swell the power of the insurrection. Many officers of the army and navy who were included in the capitulation of May 1 were among these captives. The helplessness of scattered detachments in a densely populated and hostile territory was demonstrated by these captains. The natives moved independently of roads, relying upon supplies of local production and ammunition and rifles taken from the enemy.

In none of these operations did the American forces bear a part, not even in checking the relief columns which marched out of Manila by the single road skirting the shores of the bay and exposing troops in advance or retreat to the fire of naval artillery. The progress of the insurgents was visible from our anchorage, and early in June their lines were drawn to invest Manila from the north as well as from the south. The force which captured the large city of Malabon and occupied Caloocan was led by rebels who had not allowed themselves to be included in the capitulation made when Aguinaldo went to Hong Kong. The northern leaders had maintained an active or latent rebellion during the months preceding the arrival of the American fleet, but they promptly joined the revolutionary organization and accepted Aguinaldo as dictator in May and as president in July, according to his successive proclamations.

Meanwhile, the fleet engaged in the maritime blockade of Manila Bay. Since diplomatic notification was impracticable, each vessel had to be visited for direct notification. The blockade was not of great military advantage except as it kept the garrison on short rations. The soldiers seem to have had plenty of rice to the end, but the supply of beef was soon exhausted. The blockade by land was felt more severely than the maritime investment, especially as the latter was often mitigated on grounds of humanity or to afford relief to non-combatants and foreigners. Thus the mails were regularly delivered when brought from Hong Kong by mail steamers or men-of-war. Invalids and neutrals, including hundreds of Chinese, were also allowed to take passage to China.

The legal principles affecting blockade were carefully studied and no stranger found any reasonable ground for complaining of

the methods of enforcing that undeniable belligerent right. Several vessels entered Manila Bay with cargoes of coal purchased by agents of the United States in Australia or the Far East. The legal status of these vessels and cargoes was clear and secured them from interference by cruisers of their own nation. As for danger from the other belligerent, there had been nothing to fear since May 1, when the Spanish fleet was destroyed. Neutral vessels in port before our coming were allowed every indulgence in completing their outfit for sailing. Those which carried coal were discharged for the benefit of the fleet. Some captains failed to understand the right of our government to make compulsory purchases, but were soon convinced by the text of the treaties which authorize this method of dealing with contraband of war in ports under military occupation. The treaty with Great Britain is extremely clear and rational upon this important point.

Much confusion in regard to the supply of coal to belligerents will be removed by reference to the rule announced by the British Government early in May: "No coal shall be supplied to any belligerent ship except for the specific purpose of enabling them to proceed to their own country or to some other named neutral destination with reference to which this supply of coal is given." The second clause is even more novel in its clear and direct terms: "Coal should not be supplied at all if there are reasonable grounds for supposing that it is in fact to be used for another purpose." This rule was bound to be fatal to Spanish attempts to send reinforcements to the Philippines.

In another particular the British Admiralty Instructions have an advantage over our manuals of international law and regulations. The recognition of the actual possession by insurgents of towns, forts and ships is specifically provided for. Even the display of an insurgent flag on the high seas seems to be allowed, whether belligerent rights have been granted or not. The fact that the Filipinos were insurgents against our enemy did not seem to deprive them of any right granted by Great Britain in her character as a neutral, and their flag was shown by several cruisers entering or clearing from Cavite during the summer. The Spanish newspapers made appeal to all the naval representatives of neutral powers to arrest these cruisers or pirates, but no action was taken, although one sea-going steamer, the Compania de Filipinas, which was carried over to the insurrection by

mutiny led by a Cuban belonging to the ship's company, seems to have been warned by a German cruiser that her flag could not be recognized and she could not be allowed to take part in military operations.

In immediate response to this warning the Raleigh and Concord were sent to Subig Bay, where they effected the capture of Isla Grande and turned the place over to the Filipinos, along with the troops and naval officers composing the garrison. This was the nearest approach to a direct alliance during the campaign. Most of the incidents relating to the "Tagalo-Yankee alliance" denounced by Spanish journalists were pure fabrications. In counting the slain in battle about the first of June they announced the finding of many wearers of the naval uniform of the United States. Of course this mention served to introduce other falsehoods. Aguinaldo was said to have been placed in irons on board an American man-of-war as a punishment for his failure to complete the conquest of Cavite province.

As a matter of fact, the rapid progress of insurrection was the chief ground of anxiety during the month of June. Manila was invested; the water-works were occupied; the capture of the city was confidently predicted. Aguinaldo seems to have been bound by no promises except to carry on the struggle with due regard to humanity and the laws of war. That was all that could be demanded unless mutual obligations were contracted—unless the Americans were ready to make promises to the Filipinos through their leaders. All such contracts were scrupulously avoided during the period of naval control.

The real grounds for dreading the complete success of the insurgents related to doubts concerning the ability of the leaders to control the wilder elements among their troops—the savages from the hills and the rabble of Manila. All revenges and atrocities would have been charged to the "unholy alliance" by the Spaniards and would, perhaps, have furnished motives for intrusion or intervention by some of the foreign powers represented in the bay. About the middle of June the relief crews for one squadron were brought to Manila by a chartered mail-steamer, and one power had, therefore, at least 1000 men available for landing parties. It is credibly reported that attempts were made to induce the consuls and senior naval officers to unite in arrangements for the joint occupation of the commercial quarter of Ma-

nila for the protection of the life and property of foreigners. All propositions looking toward interference with our manifest belligerent rights were bound to fail upon encountering the sturdy common-sense and straightforward diplomacy of Sir Edward Chichester, commanding H. B. M. S. Immortalité, and of the British Consul, Mr. Rawson-Walker, who, like his colleague at Santiago de Cuba, lost his life during the strain imposed by the Spanish-American war.

The English authorities represented the larger portion of the foreign section of the commercial community in the Philippines and had, therefore, a dominant influence in international councils. The German colony also claimed considerable numbers and wealth. It is said that many Swiss subjects were enrolled in the books of the German consulate for protection. It is only fair to say that the Filipinos are admitted to have been careful and successful in guarding the property of foreigners from pillage during the whole period of disturbances up to the end of 1898. Spanish property, especially that of corporations, commercial or religious, has been ruthlessly confiscated, and taxation on a severe scale has been carried out on the basis of the system established by Spain.

The international complications were more puzzling than serious, perhaps, since most of them seemed to arise from trivial instances of ignorance or inaptitude in carrying on the naval routine imposed by the situation. If so, they were sufficiently and impressively rebuked. Sympathy, probably, had little to do with the matter, but there may have been a certain tendency to aimless and tactless intrigues. Certain proprieties of the situation are so far from being obvious that some random criticism was put in circulation: thus it proved to be right for neutral vessels to salute the Spanish flag on anchoring off Manila, and to dress ship on the frequent holidays announced in honor of Spanish royalty.

It was plain that many problems would be solved by the occupation of the enemy's capital, and the arrival of the necessary troops was eagerly yet patiently awaited throughout the month of June. It is worthy of note that an excellent regiment, the First Infantry, U. S. Army, had been sent from San Francisco to Florida during the week which saw the Asiatic squadron starting for Manila. Had the prospect of an instant and complete naval victory been realized and its political and popular significance

been weighed, this transfer might not have been ordered. The first expedition, commanded by Brigadier-General Anderson, comprised about 2500 men—a force quite inadequate for the investment or assault of Manila and even insufficient for police and garrison duty. This force was therefore placed in the barracks available at the arsenal and town of Cavite.

Reconnoissance was begun by boats at an early date and it was found that the water in front of Manila was deeper than appeared by the chart, and that an extended line could cruise off the waterfront within the effective bombarding range of 4000 yards from the principal batteries, with the walled city as a background or a target for our shells. When the time for this bombardment seemed at hand the Commander-in-Chief approved a plan for placing buoys to mark the turning points and to indicate the distances while running past the town. Of course the buoys were not to be placed until the attack was imminent, and events finally seemed to render this device unnecessary.

Reconnoissances were made by officers of the army early in July, and naval examinations were also made to identify landmarks for directing the fire of ships to enfilade the Spanish trenches, and also to investigate the conditions affecting the landing of troops and supplies at various points. At Malabon, five miles north of Manila, and at Parañaque, about the same distance to the south, there were navigable rivers with entrances obstructed by bars over which less than a fathom could be carried. To the northward shoal water extended off shore more than two miles, and the roads led inland from the islands where the towns stand toward Manila. The surf was heavy, also, everywhere except to leeward of Cavite peninsula, during the southwest monsoon, which blows from June to October and freshens every afternoon. There was an advantage to the army in having a flank covered by cruisers and gunboats whose guns could be directed to rake the Spanish trenches and to protect the advance through the suburb of Malate. Therefore the southern approach was selected, and before the end of July the Filipinos were induced to abandon the sector next the beach to allow our troops to occupy and improve their trenches. The covering cruisers moved so close to the eastern shore that the Spaniards thought them aground, but found that none of their heavy guns could be trained to reach their anchorage. Naval boats and their crews, directed by able

officers, were, as usual, of great service in expediting the landing of men and stores. The native lighters, or *cascos*, were found well suited for this work when there was not much surf. Landing at the beach at Tambo saved our troops a costly circuit of some fifteen miles over miserable roads by way of Noveleta and Bacoor.

Upon going into camp our soldiers found themselves exposed to heavy rain, with very inadequate shelter tents for protection from the weather. They bore the experience manfully, worked hard in the trenches, improved in spirits and discipline, and even maintained better health than when on garrison duty in Cavite. These valuable results may be held to compensate for the trials to which they were exposed during this season of formal military operations, conducted with reference to other than concrete and visible results.

The Spaniards still held the trenches in a characteristically inert fashion. They allowed our men to step out in front of the Filipino trenches and to throw up a new line of parallel intrenchments a few rods in advance. This work was done by daylight and whole battalions were employed in making the new parapets. As the section was within easy rifle range, the defense can hardly be said to have taken their *rôle* seriously. Yet they could still waste ammunition on occasion, and on the night of July 31 they opened a heavy fire, as they had been accustomed to do for many weeks during the insurgent occupation of the same sector. The object of this volley-firing, which was often supported by artillery from the trenches or from the antique stone battery of San Antonio Abad, was not apparent. The lofty hedges of bamboo overhead were much cut up at ten or fifteen feet from the ground, but the trenches offered plenty of cover and the danger space was far in rear of the line. Unfortunately, the regiment holding the trench stood up and fired with great rapidity, reducing their burden of heavy Springfield ammunition to the verge of safety. Fresh troops were hurried up in support, and they suffered losses in advancing through the danger space. The notion that the Spaniards had sallied forth from their trenches prevailed during that night and has been given a place in many journalistic narratives. The reports of responsible officers should eliminate this notion from history. The affair cost our troops a loss of twelve killed and forty-odd wounded. The Spaniards resumed volley

practice on other evenings, but their efforts were disregarded and our troops escaped with very few losses.

Urgent requests were made to have the fleet silence the stone fort on San Antonio, which stood on the beach within effective range from deep water. This structure had been proposed as a target on the afternoon of May 1, but it was spared as bearing no relation to naval attack. Its prolonged immunity was due to a wish to avoid a general engagement until arrangements for immediate military occupation were completed. The destructive bombardment of an inflammable city crowded with women and children was a task which it was patiently hoped to avert. It was held equally desirable to guard the city from any risk of pillage and, as far as possible, to prevent its occupation by the Filipinos, who were reckoned as tractable but uncertain allies.

Another restraint was removed late in July, when the important news of the return of Admiral Camara's fleet to Spain after passing through the Suez canal was tardily received. From the first the prospects of this expedition had been discussed in the fleet. Up to July 1 few had any faith in the reality of the project of making this diversion. It seemed a false move to uncover the coast of Spain; it seemed an impracticable move to get a squadron containing a crippled battleship, weak torpedo-boat destroyers and overladen transports across the Indian Ocean and the China Sea while they were unable to make use of coaling stations. We know now what Admiral Cervera knew a year ago, that this squadron was quite unfit to cross the Atlantic. But the fact that Admiral Camara had actually entered the canal imposed the necessity of considering plans to meet his advent.

We are assured that the troops which had arrived from the United States were prepared to maintain themselves in an inland position during the absence of our fleet. This disposition implied a certain confidence in the native alliance. It also left the naval Commander-in-Chief free to remove all his ships from Manila Bay in order to make the best arrangements for guarding the transports and colliers. Assuming that the Spanish fleet was really superior to ours in fighting force, the anchorage off Cavite was hardly the place to meet it. The tactical methods of Admiral Montojo had not commended themselves in practice. The next step considered was that of sending the transports and colliers to take refuge in Subig Bay and disposing the men-of-war

to guard the entrance to that port and to threaten any fleet bound for Manila. Few officers in the fleet commanded by Admiral Dewey had any doubt then of our ability to beat off the Pelayo, Carlos V and their consorts at the end of a long voyage. Doubtless none would question the result now, especially taking into account the arrival of the Charleston as a reinforcement to the six cruisers which fought the battle of May 1.

Probably the plan of standing off to the eastward with all the elements of the fleet, in the hope of meeting the monitors somewhere in the Pacific Ocean, was also considered. A high military authority goes so far as to say that this plan of temporary withdrawal was adopted under the pressure of alarmist calculations imported with the second military expedition. This measure would have caused much concern in the United States and could hardly have improved the spirits of the fleet. Fortunately, no such expedient was ever inaugurated. Camara had turned back before the calculations were produced.

These hypothetical situations involve the discussion of the value of monitors like the Monadnock and Monterey in naval engagements and in bombardments. When the Monterey came in on August 4 the comments made on her stability as a gun platform in the ordinary swell of the southwest monsoon were far from encouraging. If the Spanish Admiral chose to fight in the open sea during the regular monsoon or within a week after the passage of a typhoon, or even if the meeting took place in Manila Bay on a summer afternoon, the Monterey's battery could hardly have been a decisive factor. The oscillations due to excess of stability would compel her to throw away her shots under such conditions. The Pelayo might have been put out of action by the same process which proved fatal to the armored cruisers at Santiago: by setting fire to her woodwork, by killing her guns' crews, by the general dismantling and demoralizing effect of rapid-fire guns, mounted to afford a clear vision and close aim, delivering an incessant storm of explosive projectiles.

If the Monterey and Monadnock were of uncertain value in a fleet action, their cruising efficiency must be rated still lower. Neither the tactical nor strategical qualities of monitors would justify a future plan of campaign which sacrificed time, moral effect and concrete results to secure such problematic reinforcements. It may be claimed that the heaviest artillery has supreme

importance in bombardment and in silencing shore batteries. Against towns any shells that can be exploded among compact masses of stores, shops and dwellings will serve the main purpose, although destruction may be made more appalling by using heavy bursting-charges. Against modern earth-works destructive effects cannot be attained by using any artillery which fires slowly or is uncertain in hitting. Craters in sandbanks do not cause structural injury to batteries. These can be disabled only by direct hits, upsetting guns or shattering mounts. Of course, the slaughter of guns' crews may also impose silence, but no weapon is better adapted for such work than those of the secondary batteries, when the objective is within range of open water.

Until all concern regarding Camara's movements came to an end it was resolved to keep the American fleet intact and to decline any movement which might bring on a general engagement. A few days more were consumed in waiting for the monitors, the first of them, the Monterey, arriving on August 4. Finally, on August 7, the naval and military commanders-in-chief united in summoning the captain-general to surrender. Twenty-four hours were allowed for the removal of non-combatants, and this time was extended for another day while correspondence was in progress. The Governor-General asked for time to communicate with Madrid via Hong Kong. Return dispatches might have been expected in about a week. He complained that there was no place outside the city to which women and children, along with the sick and wounded, might retire, since the insurgents held all the adjacent districts. Minute directions were published assigning non-combatants to the casemates for shelter during bombardment. They were advised, however, to seek safety at military posts in the outlying suburbs. Certainly, confinement to the foul dungeons under the old walls would have been fatal to many.

Fortunately for the unarmed population, no one in authority meant to expose them to bombardment. The American commanders urged surrender for the sake of humanity; the new Governor-General—General Augustin having been relieved by General Jaudenes on August 4, because of a message to Madrid pointing out the necessity of prompt surrender—admitted the force of their appeal, but declared that the council which he had called opposed capitulation. This was his official ultimatum, fol-

lowed by an informal intimation that the honor of Spain, of the army and of the captain-general would be satisfied by a simulated conflict. Since there had to be a bombardment, the fleet might shell the stone fort of San Antonio Abad, and our troops might open fire on the adjacent trenches. The town batteries would keep silence in order to avoid drawing our fire, and the troops would retire from the outer defenses as soon as they had been briskly assailed. Subject to a warning that fire from any battery would be effectively returned, this message seems to have been made the basis of a mutual understanding.

The morning of August 9 had been selected for beginning the attack, but it was found that the army needed time to reconnoiter the approaches to Malate and to land more men and stores at Camp Dewey, on the beach north of Parañaque. The state of the tides had also to be considered with reference to fording the creek close to San Antonio Abad. These requirements delayed aggressive movements until Saturday, August 13. It was felt that this delay might entangle us with peace negotiations, which would leave our troops in an embarrassing situation unless a valid capture was effected before documents were signed. As it turned out, the capture was a day late, a suspension of hostilities having been announced on August 12. The possession of the bay and city of Manila was, however, covered by stipulation, and for the rest Spain was unable to offer any effective protest.

It may be assumed that all general officers on both sides were duly informed as to the nature of the demonstration which began at 9.30 A. M. on Saturday. Excellent maps had been obtained from Aguinaldo's headquarters, and they had been supplemented from other sources and by reconnoissances. The fleet could be held in check by signals, but the task of brigade-commanders, regulating the advance of troops through thickets and rice fields, was somewhat harder, complicated as it was by an effort to intercept the advance of the Filipinos from the posts which they held close to the Spanish trenches in the northeasterly prolongation of our line. The effort to comply with the request of the Spanish captain-general that our lines might be extended to the Pasig River left gaps by which the insurgents entered the city, and introduced some confusion into the progress of our own forces.

The advance of our right wing along the beach was covered

by the guns of the ships, which were also able to batter the stone walls of Fort San Antonio and to rake the trenches beyond. Some persons seem to have fancied that the fleet had no other function in this attack, but those who had heard the guns of May 1 knew better. With the Olympia, bearing the Admiral's flag, within 3000 yards of the principal batteries and well inside the three-fathoms curve, with the Baltimore, Charleston and Boston close to the end of the breakwater, the Raleigh and Petrel covering Fort San Antonio, and Concord closing in toward the mouth of the Pasig in readiness to take Fort Santiago, the situation was hopeless to all intelligent observers from the walls and towers of Manila. Spanish accounts insist upon the dominating power of the fleet led by Admiral Dewey. We may not borrow their terms of comparison, but we may remind ourselves of the facts.

The actual operations of the day began by brisk firing from the Olympia, Raleigh and Petrel at the fort of San Antonio, which lay silent and almost deserted outside the Malate suburb. As we steamed to the eastward the morning light was deceptive, the smoke hung heavy in our path, and the landmarks were shut in by baffling showers of rain. As the fall of the shot could not be noted for correcting the ranges, the firing was wild for the first ten minutes. For the rest of the hour, although we lay in white clouds made by charges of brown powder and red clouds made by smokeless powder, it was fairly accurate, many shells grazing the parapets to rake the trenches further inland, others exploding against the masonry of the fort, and one, at least, penetrating the wall and scattering splinters of stone and small-arm ammunition about the interior of the works. The slight impression made by shells which failed to explode or which burst without penetration was rather disappointing, but it soon became evident that our fire was thoroughly effective.

An officer long since honorably distinguished as a military critic and historian assures the public that the firing practice of the fleet was inferior to the performance of their batteries on May 1. Percentages are not available for the discussion of this problem, but it is plain that the desired result was accomplished on both occasions. The enemy was driven out of the batteries and trenches quite as soon as their occupation could be attempted. Yet only three ships fired, while five were held in re-

serve. Nor did the Olympia and her consorts use their secondary batteries, although within effective range. Every precaution was taken to keep the guns under strict control and to cease firing when the army signalled its readiness to go forward.

Under these circumstances it is hardly profitable to thrash out comparisons of naval marksmanship with that of the field batteries on shore. One excellent volunteer battery had its guns well advanced some weeks before the attack and fired at a familiar target over a measured range about one-third as long as those estimated from the ships. No doubt their guns made a fair percentage of hits and produced as much effect as their weight of metal would allow—as much as they had ever produced during previous artillery duels. But the gunboat Callao, which skirted the beach and drove the enemy through Malate as our troops advanced, was capable of doing the work of more than one battery of field artillery moved by hand. Scarred as she was by rifle bullets, they could not reach her motive power or the spirit which held her on her course along the enemy's flank.

Another error was given circulation in a reporter's version of an interview with an officer of rank while on his way to Paris in September. The printed report contains these remarks with reference to the affair of August 13: "The Admiral did not wish to risk his ships and kept a good distance off. He made excellent practice all the same; but at that time he had nowhere to send to get repairs." As previously noted, Admiral Dewey had ships drawing twenty-four feet cruising within the three-fathom curve and within effective range of the heaviest Spanish batteries. There was too much confidence in the power of the fleet to admit the sort of caution here suggested. The story belongs with the tale of English gunners hired in Hong Kong—with the fiction of a consular pilot at the entrance of Manila Bay.

The advance of the troops in column along the beach was a fine sight, but when our men were seen fording the stream near Fort San Antonio every one was glad that the Spanish troops had quitted their trenches beforehand. Otherwise the experience of the naval landing-party at Fort Fisher might have been repeated under these walls. Finally our troops began to mass themselves in the open space of the Luneta promenade, close to the moat of the walled city. The signal of surrender was at last shown, according to agreement, and officers of the military and naval

staffs landed to draw up the terms of a preliminary capitulation. They were soon followed by Major-General Merritt, who ratified the terms of surrender, which were made as liberal as possible, and took measures to restore order in the city and its suburbs.

The Second Oregon Regiment had been held in a light-draught transport and they were promptly landed on the quays commanding the river and placed on guard within the walled city. Though they had not been under fire, they were as readily available for this important service as their comrades who had marched in through the mud, losing half a dozen killed and the usual proportion wounded in accidental encounters with the retreating Spanish infantry. Of course, the Spaniards had also suffered losses; soldiers had fallen for the sake of military honor—not with any purpose of prolonging the defense. Such dramas of advance and retreat need more careful rehearsal if useless sacrifices on both sides are to be avoided.

The Spanish flag continued to wave from Fort Santiago until the capitulation was signed. Then it was hauled down by two signalmen from the Olympia directed by Lieutenant Brumby, Admiral Dewey's flag lieutenant and his representative in drawing up the terms of surrender. It was fitting that this officer should perform a service of such distinction, and no narrative of the campaign of Manila Bay would be complete unless it laid stress on the conduct and abilities which earned him this high honor. A company of Oregon volunteers with the band of their regiment came up in time to render due honors to the huge flag sent ashore from the Olympia.

While the capitulation was in progress the gunboats Cebu and Bulusan, along with steam-launches and other boats, were wantonly sunk or burned under the eyes of the Spanish naval officers. These incidents revived some distrust of the loyalty and discipline of the garrison, and Admiral Dewey directed the breech-plugs to be removed from all the modern guns along the western face of the fortifications. This task was performed on the morning of August 15, the working party meeting with no objection or inquiry on the part of any one in authority, though squads of Spanish artillery-men were still quartered in the well-filled magazines of the two 24-centimeter guns outside the moat. In all, twelve guns were dismantled and their breech-blocks were stowed on board the Olympia. The era of proclamations and

negotiations relating to the insurrection now began, and the Filipino leaders were induced to withdraw their troops from the city a few weeks after its capture from the Spanish.

No maritime prizes were taken at Manila, although a dozen sea-going steamers belonging to Spanish owners lay in the river along with many tugs and sailing vessels. Several steamers had been allowed to anchor in the bay to accommodate foreign refugees under foreign flags. This arrangement was a matter of agreement between the consuls and the American naval Commander-in-Chief. The legal status of these vessels was in no wise affected thereby, but it was decided at Washington that no lawful prizes could be taken in joint operations of the army and navy. So the Spanish owners resumed possession of their ships and were allowed to cruise with them under the American flag, some citizens of the United States being found to lend their names for that curious and informal transfer by which a bill of sale acknowledged before a consul is made to serve as an American register for ships which may not enter American ports. The same expedient was adopted on a large scale in 1884, when the fleet of the China Merchant's Navigation was placed under the American flag to avoid capture by the French. This device would hardly survive investigation by a critical belligerent. In this case the intention seems to have been to avoid seizure or detention by Filipino local administrators. In this the Spanish owners were for a time fairly successful, though protests and interferences occurred both from Spanish and native authorities.

The rest of Luzon and important stations on the other islands were surrendered to the insurgents within a month after the capture of Manila. Had the leaders been well advised, or had their troops been under such discipline that they could be safely disbanded without relapsing into brigandage, or could they have been withdrawn from the suburbs of Manila, where many of them had their homes, subsequent collisions and irritations might have been avoided. Besides this blunder of Aguinaldo's, other indications of trouble darkened the horizon.

An able American correspondent who came out in July was allowed to send cablegrams to the *London Times*, dated at Headquarters, Cavite, July 29, which may be taken as significant if not inspired. Adopting inaccurate rumors of lavish distribution of arms and ammunition from the Cavite arsenal for the free use of

the insurgents, and denouncing the early relations of American authorities with the native leaders as gross mistakes, this newly-arrived and imperfectly-informed critic declares that "revenge and plunder" are the only incentives which lead the Filipinos to continue the conflict. These opinions are in plain contradiction to those previously expressed by responsible representatives of American authority. They serve, however, to introduce the opinion that "the only means of controlling Aguinaldo's rabble is to disarm the whole population." Six months later, after the army of occupation had been doubled in force, this difficult and costly undertaking was inaugurated, with results which history will enumerate and appraise.

The published narratives of this campaign, and especially those of the battle of May 1, demand some measure of attention. These reports vary in value according to the actual opportunities of the observer, his capacity for understanding what he saw, and his caution in avoiding romantic illusions and restraining the natural desire to exalt the achievements of his particular ship. Of the journalists, more or less present as spectators, Mr. Stickney had the advantage of technical knowledge and a position on the bridge of the Olympia. Reports cabled by passengers in the McCulloch were of more value in their original form than in that given them in the offices of newspapers addicted to the literary vice of expansion even before they learned to advocate the national policy which bears that name.

Of a certain eager "eye-witness" who was first in the field as a lecturer it is sufficient to remark that in publishing a list of officers and men who were on the forward bridge of the flagship he displays total ignorance of the customs of the service, of the necessities of navigation and of the official report of the Commander-in-Chief. Moreover, the editorial department of a leading magazine accepted his communication without checking it by that important document. After that it hardly seems worth while to attempt the correction of this chronicler's facts, although it may be allowed that his record of personal impressions is not destitute of interest.

Of the narratives enshrined in well-bound volumes it is sufficient to say that few of them have escaped the taint of "expanded" cablegrams, or of that curious mixture of rumor and fabrication labeled "With Dewey at Manila," compiled by

Thomas J. Vivian. This begins like a second-hand version of an authentic letter, but closes in scenes of melodramatic confusion. Mr. John R. Spears finds his surplus torpedo-boats there, and Hon. Henry Cabot Lodge borrows a series of duels and explosions from this unhistoric reporter. Maclay's "History of the Navy" was an early gleaner in the field of imagination, bestowing the Spanish fleet behind a breakwater of stone and timber only represented in reality by a few stray iron lighters, some of which were laden with sand to cover the water-line of the Castilla.

Many of these distortions of history are due to wanton impulses toward sensationalism. Spanish narratives suffer from the same defects, and those printed in Manila were warped by the restraint imposed by the Governor-General's decrees of warning. Among the minor offenses classed as high treason was that of "publishing any statement which might tend to discourage the defenders of the country." For this crime a summary court-martial had its choice of penalties between death and imprisonment in chains for life. Yet the daily journals of Manila were able to resume publication on May 4 and to give a fairly intelligible account of the events enacted under the walls of their city. Even the trimmed cablegrams of the captain-general were sufficient to reveal to the journals and public of Madrid the tragedy of Spanish defeat, and riots broke out in a score of Spanish cities—crude revolts against incompetence which had brought about national humiliation and social misery.

Many curious details concerning the defenses of Manila and the complex methods of Spanish naval administration were accessible among reports filed in the office of the commandant of the arsenal at Cavite and in the mansion in Manila occupied by the admiral commanding the station and squadron of the Philippines. These papers show that much zeal was manifested in improvising armaments during the month of April, but that supplies and methods were alike defective. Even information seems to have been scanty, since Admiral Montojo claims to have gone to Subig in ignorance of its actual defensive condition and to have been surprised and disgusted at the deficiencies and delays which induced him to bring his fleet back to meet its fate at Cavite.

Yet the advantages of the port of Subig and the development

of the naval arsenal at Olongapo, on the eastern arm of that excellent harbor, had been studied by a series of special commissions from 1885 to 1898, at an annual expense of some $20,000 (Mexicans), which was duly charged to the Filipino budget each year. The removal of the naval establishment from Cavite was strenuously opposed by officers concerned about the comforts of the capital and by contractors anxious about investments in Cavite and profits to be made on supplies. A memorial opposing the transfer was prepared by some naval officer and printed at the expense of two well-known Filipino contractors about 1890. The political situation of the country is shown by the fact that both these agents, Osorio and Inocencio, being known as millionaires, were arrested and shot by sentence of a summary court-martial in September, 1896. Possibly this may account for the rarity of the volume issued in support of their interests.

A pamphlet containing an able refutation of their arguments was privately printed in 1894. It was written in 1891 by Captain del Rio, who seems to be a man of ability and is certainly the most unfortunate officer of his rank serving in the Philippines in 1898. Seven years after his plea for the fortification and equipment of a naval arsenal at Subig he was called upon to perform the miserable task of improvising defenses with inadequate means. The results did not inspire confidence, and in the council which decided upon the transfer of the ships to their last berth off Cavite, Captain del Rio was the only advocate of the plan of fighting at Subig. The majority of captains accepted the dreary argument that they must fight in shallow water to give their crews a chance of escaping to the shore.

The pamphlet printed in 1894 urges the fortification of Subig as a naval station and the abandonment of Cavite as lacking both the nautical and the military conditions required to place a fleet in security. Without placing too much stress on the alleged shoaling of the water, we may agree with the author when he denies that ships can be moved near the arsenal out of range of the enemy's cannon, as well as in the following opinion: "Huddling ships around the arsenal involves the demoralization of their crews without guarding them from the enemy's projectiles; it sentences them to a fate as inevitable as it is inglorious." Point by point he predicts the advance of an admiral "whose fleet is stronger than ours, but not twice as strong"; he will re-

connoiter Subig, standing on in good heart if he finds that port vacant. If he finds the Spanish fleet at Cavite he will destroy the ships and the arsenal, and bombard Cavite at his leisure. The partisans of Cavite endeavor to present a plea for defending the entrances of Manila Bay; their plan includes seven batteries, the number actually installed on May 1; then, 1310 torpedoes and four first-class torpedo-boats. Moreover, a naval squadron is required, and Captain del Rio demonstrates that it must be at least equal to that of the enemy. For, as he asserts, the batteries will be isolated and incapable of mutual support if the enemy chooses to make successive concentrated attacks. The torpedoes are bound to go adrift in the swell and currents sweeping through these deep channels, and they will then be as dangerous to the vessels of the defense as to those of the attack.

Besides these sound theoretical considerations it may now be added that an unarmored squadron can safely run past any batteries which the resources of Spain could erect on the shores and islands of the Boca Grande. The demonstration has been made, and a tenfold increase in the efficiency of the batteries and the vigilance of their garrisons would not have checked the advance led by Admiral Dewey.

The argument in favor of Subig was resented as implying disregard for the wealth and importance of the capital. But our author points out that, since all the millions which the wealth of Manila represents can neither close the mouth of the bay nor make Cavite a safe shelter for a fleet, it is seeking the impossible to endeavor to protect a city on the open coast of a wide bay from the shells of a hostile squadron. The conservative view is expressed in the following proposition: "The creation of an arsenal at a distance from the site of one already installed, when the material and moral forces requisite are wanting, is a rash effort for the navy to undertake." Admitting the existence of Cavite and the scarcity of means, Captain del Rio insists upon the removal, "if the navy is to be spared a ruinous failure whenever circumstances impose the duty of mobilizing the forces provided by the nation." The argument for Subig might have been strengthened by applying the principles of strategic defense in connection with *ports de sortie* as presented in various discussions at the U. S. Naval War College since 1887. No squadron invading this coast and seeking to attack Manila could afford to

neglect a fleet occupying Subig. Lines of communication would be threatened, scouts and colliers picked off, and ships engaged in military blockade would be neutralized and exposed to defeat if the balance of power became uncertain. These considerations apply with equal force to the fleet under Admiral Dewey in April and that under Admiral Camara which caused speculation in July. Both were maritime invaders and liable to checks under the rules of naval strategy.

The technical and financial details furnished by Captain del Rio show that from 1885 up to 1891 the equipment of the arsenal at Subig had cost $116,774 (Mexicans), and the commission's reports had cost $144,155. The commission was still reporting in 1898, but the installation had probably got ahead of the discussion in expenditures. Certain ranges of substantial shops and storehouses had been erected and a floating dock ordered in England. This dock, of the sectional, self-docking type, was ready for shipment at Newcastle-on-Tyne early in 1898, and the owners were anxious to sell it to the American Government or any purchaser prepared to pay the contract price of £35,000. Of course, no stone dock would answer in this land of earthquakes. A dredging plant was also under contract to be used in completing basins off the tract in the delta of the Rio Santa Rita, near the village of Olongapo. This delta seems exposed to floods, but we are assured that the water can be diverted into the mangrove swamps to the eastward or made to flow through the channel on the west side of the delta. It is admitted that the Bay of Subig cannot be connected with the capital by railway without vast expense. The direct route would lead over a chain of mountains into the delta of the Pampangas River. The most practicable route would branch from the northern section of the Dagupan railway. Obviously, all this discussion and demonstration has a certain value with reference to the future of the Philippines under American control. Whenever the situation can be regarded strictly from a naval standpoint Cavite must be allowed to decline, though a small coaling station might be kept up in Cañacao Bay. Of course, while the navy is employed as an adjunct to military and political enterprises in the provinces adjacent to Manila this transfer must be postponed, but when civil government is established and accepted, the strategic and nautical advantages of Subig should prevail over the political, social, and commerical claims of Manila.

A similar question was fought out about a century ago when a trivial naval establishment on the banks of the Pasig River in Manila was sacrificed to the development of the arsenal at Cavite. Powerful influences opposed the change. Navy yard billets had become the spoil of political adventurers and social parasites who would have to give up their places if work had to be accomplished. The remedy was heroic, considering the traditions of Spanish administration. The navy yard at San Blas in Mexico was closed and all its foremen and managers were transferred to Cavite, where they were able to do the state some service. Yet traces of the old system remain. The admiral commanding the station and squadron in the Philippines had his office and mansion in the San Miguel suburb of Manila, where he lived surrounded by a large staff of officers, selected for obvious family or social reasons in many instances. This involved the duplication of papers and employments, since the work had all to be done over again at Cavite in the office of the "Commandant of the Arsenal and President of the Administrative Board."

In the office file for April 29, 1898—the last day for which the correspondence of Cavite arsenal was duly registered and jacketed—there was found a series of documents illustrating the course of Spanish circumlocution. The commandant of the naval division of Yap in the Caroline Islands made requisition for a coal-lighter. The commandant-general of the station sent it to the commandant at Cavite, who assembled the Administrative Board to consider the affair; the naval constructor (*Ingeniero*) was directed by the Board, of which he was a member, to report as an expert on the project. His recommendation was duly adopted and forwarded, requiring the man at Yap to estimate the exact amount of material and labor required. In due time his estimate came back, and, passing through the same circuit, was sent to the Minister of Marine at Madrid. Thence came a decree from the Queen Regent of the realm, who, in the name of her son (q. D. g.), ordained that the said coal-lighter should be constructed with the number of boards, quantity of nails and days' work as specified. The total circumnavigation seems to have stopped at Cavite just six months after the original application. The existence of the coal-lighter remains problematic.

The navy secured its documents with white tape; the army,

with stripes of red and yellow. Both use cumbrous forms and obsolete compliments in trivial reports and "expedients." The intrusion of another department of the national establishment appears in the printed forms of court-martial orders, which contain a clause requiring members to attend a "Mass of the Holy Spirit" in the chapel half an hour before the time set for the meeting of the court. Considering the facts that the charges are often based on testimony founded in torture, and that the sentences were generally cruel and unjust, this invocation seems somewhat out of place. The army regulations of Spain are perhaps the only ones containing diagrams of parades for the execution of the penalty of death and for the still more atrocious ceremony of military degradation. The history of Spain in the nineteenth century shows that such lessons have their natural effect on the officers who serve as judges or as "fiscals" in prosecuting military and civil offenders. The Official Gazette of Manila in 1897 and 1898 was full of proclamations threatening the life, liberty and property of deserters or civilians on the authority of junior officers of the army and navy detailed as judge-advocates of summary courts.

The complexity of naval administration is exhibited in every public office by shelves filled with carefully annotated and indexed volumes of "Laws relating to the Navy." The actual political system of Spain allows the Ministry to name and control a working majority in the Cortes and to pass all laws introduced. Bureaucrats seem to demand at least one stout volume for each year, and documents—if not facts—must be shaped according to their requirements. The foundation of all naval discipline is contained in the two volumes of *Ordmanzes Generales* of 1793, tall copies of which are found in every ship and in every administrative library in the arsenals. The amazingly systematic and complete form of this work suggests that it was drawn up in the reign of Charles III., the last period when Spain was governed with ability by a king who knew how to strengthen his cabinets by employing the talents of foreign adventurers, Italian and Irish. Yet this monumental code was responsible for the armadas which met Jervis at St. Vincent and Nelson at Trafalgar. Of course, successive accretions of arbitrary complexity have helped to further cripple the powers of later generations of naval officers. We may be thankful for the rough simplicity of Anglo-

Saxon ideals—for the tendencies which, in their best days, seem to prefer common-sense to beaurocratic counsels of perfection.

The cramping influence of this over-wrought administrative mechanism, combined with the failure of intellectual interests and industrial development to counteract the mediaeval obscurantism of the dominant forces in the Philippines, may account for the prostrate condition of the Spanish naval squadron in 1898. The navy had more than two hundred commissioned officers on that station, yet half the ships were out of repair or defective in equipment. Crews were untrained and incapable of marksmanship. Nepotism glares from the pages of the squadron naval register and there were visible efforts to establish easy routine as a mitigation of the pains of exile. The higher officers were better paid than those of like standing in the United States Navy and were luxuriously accommodated in official residences. By the lower grades tropical slackness seems to have been accepted in lieu of more substantial rewards. No strategic purpose and no technical studies seem to have directed the plan of campaign. Half the Archipelago remains unsurveyed, and the defensive conditions of the approaches to the capital and to the new naval arsenal at Subig seem to have been ignored by the responsible authorities until long after Admiral Dewey had concentrated his cruisers at Hong Kong. American naval officers will at least know what to expect if the example of their predecessors in the Philippines shapes the future of the new colonial administration.

Some notes on the history of naval campaigns in the vicinity of Manila may serve to conclude this rambling series of incidents and impressions. The adventurous navigation of Magellan and later explorers of the sixteenth century must be passed over without comment, except a reference to the fact that their crazy armadas seemed to run foul of the Philippines while in search of Japan or of the Moluccas, or Spice Islands. The first naval attack on the Spanish settlement at Manila was made by the famous Chinese pirate, Li-ma-hong, at the head of a fleet of sixty junks carrying some 4000 soldiers. He made several attacks in 1674, landing his troops at Parañaque and making successive attempts to storm the feeble breastworks of the town. He showed persistence and resource. For instance, he drew the fire and occupied the attention of the garrison by sending a flotilla of fire rafts to drift along the beach at night while his storming parties at-

tacked by land. But he was beaten off and retired to the Gulf of Lengayen, where he established himself on shore, only to be driven off, a few months later, by the Spanish Captain, Salcelo.

The next invader was more terrifying, if not more formidable. A fleet of Hollanders, whom Philip II. had striven to punish as rebels and traitors, made its way into the Pacific and the two surviving ships reached Manila in 1600. Batteries covering the town of Cavite were hastily erected and two guns were mounted on Sangley Point, where we found their successors in 1898. The Dutch lay at Mariveles for two months, blockading the port and capturing various prizes. Finally the Spanish were ready, and two large galleons, each carrying a hundred men-at-arms besides the crew, closed with the Dutchmen off Mindoro. After some casual cannonading the Spanish boarded the Dutch flagship, carried the poop, and took the masthead flag and the ensign at the peak. The Dutchmen fought in the waist in their usual dogged manner. Their Captain-General, Oliver de Noort, roused their Dutch courage after several hours of sluggish fighting, and they drove the Spaniards back to their ship, which sunk as soon as they got on board. Their Captain-General was Dr. Antonio Morga, Justice of the Royal Court, who wrote a curious history of his brief naval career. It seems uncertain whether the ship went down because the Dutch had kept up a steady fire from their main deck, or because she was strained by the discharge of her own cannon. Anyhow, Dr. Morga had, as he tells us, to swim for four hours with the two captured flags wrapped round his waist before he and his trophies were rescued.

The Hollander made sail for Borneo with only forty-eight men alive, half of them wounded, six having been slain. He was able to refit and to complete his voyage round the world, the first of his sea-faring nation to perform that feat. His consort, the yacht known in the Spanish story as the Almiranta, the second in command of a fleet being called the Admiral in those days, was captured with thirteen out of her crew of twenty-five still alive. The prisoners were distributed among the convents to be converted and absolved from their heresies. Their captain remained impenitent, and so earned the right to have his name honorably mentioned. Lambert Vriesman and his men all shared the same fate, as they were duly garroted on the beach before Manila.

A generation later the Dutch held the Straits of Malacca and

were established in the Moluccas to the southward and in Formosa to the northward of the Philippines. They had thus secured strategic command of the Eastern Archipelagoes. The Spaniards had never dared to trade by the route around the Cape of Good Hope, but had limited the trade of the Philippines to the annual galleon for Acapulco. The Dutch were now in position to intercept the traffic and threaten the Spanish dominion in the Far East. But they did not send the best ships to these waters, and the Spaniards claimed the tactical advantage in several inconclusive contests which took place about the middle of the century. (1640-1655.)

They attribute their partial successes to the strength of the hulls of their galleons, built in the Philippines of the hardest and heaviest timber in the world. Nowhere else could ship-building be carried on to equal advantage, as ships were cheaper as well as stronger than those built elsewhere. The cheapness was due to the use of forced labor—thousands of lives being sacrificed in getting out ship timber; the strength, to the lavish use of hard wood in the hulls. This may have accounted for the slowness which doomed them to frequent captures, and for the clumsiness which caused them to be cast away on so many inhospitable shores in Japan or among the Ladrones. Had not the trade of Manila been strangled by the rules imposed by authorities in Madrid, in Manila and in Mexico, the commerce of the islands might have built up a mercantile navy fit to serve as the basis of sea-power. But the Spanish genius did not manifest that tendency, nor did the theories of protection and colonial exploitation allow foreigners to trade to any Spanish possession.

The Dutch sent a fleet into Manila Bay about 1645, but their captain anchored before attacking Cavite. The ablest Governor of the Philippines of that century was then expiating his activities in the prison of Fort Santiago. From his windows he saw the Dutch squadron at anchor and declared that the enemy had missed his opportunity by this delay. A sudden attack would have been fatal, but there was time to collect powder and troops and to move ships under the batteries before the bombardment began. There was much cannonading for a day or two, but there was no decisive result. The invader was allowed to ravage the adjacent coast, but he took nothing from his attack on Cavite and did not assail the capital. In another engagement off Cape

Bolinao the Spanish victory was marred by the conduct of one captain, who ran away from the fight and burned his ship in a safe harbor—to save her from the enemy, according to his report. However, "being a nephew of the Governor," he was duly promoted for this action.

The conquest of Formosa by the Chinese corsair, Coxinga, who had gathered the remnants of Chinese opposition to the Tartar conquest, put an end to the Dutch enterprise in that region and gave Manila a breathing space. The pirate king of Formosa proposed to extend his conquests to the Philippines, but died in 1662, before he found time to equip a squadron for the purpose.

The pirates of Sulu and Mindanao occupied the attention of the local naval forces for two centuries more, but no serious shock to Spanish authority occurred until 1762, when an English fleet of thirteen vessels, carrying some 7000 soldiers, entered the Bay of Manila, bringing news of the declaration of war and demanding the surrender of the islands. The English landed below Malate, took Paco and Ermita, and planted batteries to breach the walls. The city surrendered in a few days. The Spaniards still tell tales of the archbishop who was acting as Governor-General, accusing him of being "a feeble and irresolute American," that is, a Mexican. Then there were traitors, and the English were aided by Chinese, by convicts, and by rebels. They are said to have fired 6000 shells and 30,000 round shot during the siege. An important rebellion encouraged by the invaders overran the northern provinces during the English occupation, but the natives nearer Manila were organized into bands led by Spanish soldiers and monks, and the foraging parties sent out from Manila were frequently annoyed by these guerrillas.

The archbishop had agreed to pay a ransom to save the city from pillage, and had drawn on Spain for part of the money. In 1764 peace was declared and the English restored Manila, as well as Havana, taken in the same year, to Spain. The Spanish Court felt strong enough to repudiate the archbishop's bond for indemnity. It was a common superstition among Englishmen, and even among Americans at Hong Kong in April, 1898, that this repudiated and outlawed claim gave England some sort of a lien on the Philippines, and that we might be warned off if we threatened Manila. Of course, no responsible or well-informed

Englishmen held this notion. The withdrawal of the English from the Philippines was due to a policy based on recognition of the strength of Spain under Charles III.—not to any local intimidation, though Spanish writers assure us that the English "had great luck in being able to quit a country that had cost them so much blood and in which they had won no more soil than that they stood upon." Such vain boastings would have been repeated had the Paris Conference made a different disposition of the Archipelago in 1898.

There were no more international contests in these regions until Admiral Dewey appeared on the scene. Rebellions succeeded each other at intervals of about twenty years, and the Spanish Navy had some share in suppressing them in the smaller islands of the Visayas group. In Luzon such affairs were left to the army. The navy also got the upper hand of piracy about 1870. Fast gunboats at last enabled the Spanish seamen to catch the Malay skiffs, and breech-loaders gave them a like advantage over the deadly edge-tools, the *campilans* and *krisses*, which had so long given the Moros the advantage in close encounter.

The navy had done its share in repressing the great rebellion which broke out in 1896. This work had not been of the most honorable character, and discipline and efficiency may have suffered during the hateful task of burning towns and shooting prisoners. Few, if any, officers had missed winning one or more crosses of naval merit in their campaigns. But the navy was in bad condition when the hour of battle arrived: some ships had rusted out in idleness; others had been strained by their own batteries while bombarding villages at ranges of 11,000 meters. Moreover, there were indications of distrust and discouragement in all the dispositions made to resist the American attack. There was no lack of warning, and Admiral Montojo had written a telegram to Madrid on the morning of April 30, announcing that he was making ready to meet the American fleet, which had passed Bolinao at dawn.

The preceding notes do not offer a closely knit narrative of the actions described. Still less do they abound in facile enthusiasm, in personal gossip, or in dramatic incident. All these things have been attempted—perhaps some have been accomplished—but there remain individual impressions and unofficial opinions which may invite discussion and therefore suggest in-

struction to those who form their own conclusions on a basis built up of such fragmentary testimony. Of the intense interest inspired by an event for which a whole naval career has been more or less a season of conscious preparation, there is no need to speak. The last verse of a noble poem written by an American woman on May 3, while all our friends were waiting in darkness, sums up one conviction which lay deep in the hearts of hundreds of men on that fair Sunday morning: "Sworn were we ever to this—now the hour and the test are at hand." And for that hour and that test there was confidence, because the Olympia bore the flag of a leader whom all knew to be strenuous, alert, and unwavering in his resolute advance. That trust made it good to be there, and will make the memory of that morning's work a precious inheritance to be transmitted to our children and to those who may be called upon to keep alive the traditions of loyalty to the Navy and to the Great Nation which we should be proud to serve.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

EFFECT OF GUN-FIRE, BATTLE OF MANILA BAY, MAY 1, 1898.

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INTRODUCTORY.

This report on the Effect of the Gun-Fire of the United States Vessels in the Battle of Manila Bay, by the Intelligence Officer of the U. S. S. Baltimore, has lately been received. In transmitting it Admiral Dewey calls attention to the value of the information contained.

The conclusions drawn by Lieutenant Ellicott at the end of his report are particularly interesting.

RICHARDSON CLOVER,
Commander, U. S. N., Chief Intelligence Officer.

NAVY DEPARTMENT, *March 27, 1899.*

Approved:
A. S. CROWNINSHIELD, *Rear-Admiral, U. S. N.,*
Chief of Bureau of Navigation.

U. S. S. BALTIMORE, *Iloilo, P. I., January* 1, 1899.

SIR:—I have the honor to submit the following report on the effects of the gun-fire of the United States fleet upon the Spanish war vessels in the battle of May 1, 1898, and respectfully request that it be forwarded to the Office of Naval Intelligence. The report is based upon a personal examination of all the vessels, personal conversations with officers who served on them in the action, and extracts from Admiral Montojo's official report.

Reina Cristina.

This vessel was the flagship of Admiral Montojo during the greater part of the first engagement. She received a large concentration of gun-fire and was placed hors de combat by conflagrations fore and aft, the destruction of her personnel, the destruction of her steering gear, and the bursting of a shell in her superheater. She was then sunk by the Spaniards and abandoned in shoal water under the north wall of Cavite heading eastward, where she burned, with bulwarks awash. During the conflagration there were frequent heavy explosions. The injuries visible above water afterwards were as follows:

One large shell across bulwarks at break of forecastle, cutting away starboard lower boom.

One large shell swept bridge, apparently from starboard to port, and destroyed starboard search-light. This may have been the shell described by Admiral Montojo as destroying the steam steerer.

In the forward smokestack the following shells: One 8-inch low, one 8-inch high, one 6-pounder low, one 6-pounder high; and in forward escape pipe one 5-inch and one 6-pounder midway.

In ventilator forward of after smokestack, one 6-pounder waist high and one 6-pounder midway.

The after smokestack fell 60 degrees to port, probably caused by the large shell mentioned by Admiral Montojo as exploding in the superheater. This stack was struck, apparently while still upright, by one 8-inch shell low, two 6-pounders near the top, and one 5-inch midway.

Underneath topgallant forecastle one 8-inch shell entered near the deck and close under break of forecastle, going from port to starboard and forward at an angle of 45 degrees, and burst under the forecastle, a large fragment passing out on starboard side.

Two 5-inch shells also penetrated under the forecastle on port side well forward, 6 feet above deck, and burst.

One 5-inch shell entered on starboard side in same locality and passed out on port side without exploding.

The mizzenmast, although much burned, showed evidences of having been pierced six times, and the fore and main masts once, by shells of various calibers.

The starboard after-launch's davit was shot away, as if by a large shell.

An 8-inch shell pierced the shield of the port forward 16-centimeter gun, above and to left of the breech, and exploded, slipping the elevating arc band just its width to the rear and wrecking the elevating wheel, rod, and pinion on left side of gun. A fragment of this shell wrecked the elevating gear on the right side of the opposite gun. The portion of the shield penetrated sloped at an angle of about 30 degrees with the axis of the shell. The bursting of the shell about 2 feet in rear of its point of impact was co-ordinated by a huge hole torn upward in a sheet-iron bulwark rail arched over the sponson embrasure.

Admiral Montojo reports additional injuries as follows:

A shell burst on the forecastle, disabling all the crews of the four rapid-fire guns and driving splinters from the foremast which wounded the helmsman, who was steering on the bridge.

A shell burst on the orlop deck, setting fire to the lockers of the crew, who fortunately succeeded in putting out the fire.

The enemy . . . covered us with a hail of rapid-fire projectiles.

About half past 7 a shell completely destroyed the steam steerer.

Another shell exploded aft, putting nine men out of action.

. . . . Another carried away the mizzen truck and gaff, bringing down the ensign and my flag, which were immediately replaced.

Another shell burst in the wardroom . . . and destroyed the wounded who were there under treatment.

Another burst in the after ammunition room, filled the compartments with smoke, and prevented the coupling of the handwheel. It being impossible to keep down the fire, this ammunition room had to be flooded when the cartridges were beginning to explode.

Amidships . . . a large shell had penetrated the superheater, putting out of action a gunner's mate and twelve men who were serving the guns.

Another disabled the starboard bow gun.

. . . The fire forward was renewed by a shell which penetrated the side and burst on the orlop.

When many men had already been saved . . . a shell killed her heroic captain . . . who was directing the rescue of the crew.

Summing up, it is in evidence or officially recorded that the Cristina was struck by five 8-inch, five 5-inch, and thirteen other large shells, and by seven 6-pounder and nine other projectiles, or thirty-nine projectiles in all. These are not all, as Admiral Montojo reports having been covered by a hail of rapid-fire projectiles, and in conversation has estimated that the Cristina was hit about seventy times.

CASTILLA.

This vessel had developed such weakness in steaming to Subig Bay some days before the battle that she was not underway on the 1st of May, but in the beginning of the engagement was moored head and stern in the line of battle, her port broadside bearing. A string of iron lighters loaded with sand was moored in prolongation of Sangley Point to protect her water-line. During the engagement her bower chain was cut by a shell and from the impact of another shell she swung around till her starboard broadside was presented. Being a wooden vessel she was readily and repeatedly set on fire. About 10 o'clock, while the United States squadron was drawn off, her flag came down, either by design or accident, and she burst into flames fore and aft. She then sank until her main deck was awash, and her bulwarks and upperworks were completely consumed by flames. Her forward smokestack fell 60 degrees toward the starboard quarter, probably weakened, like the Cristina's, by the explosion of a large shell. Next to the Cristina she received the greatest injury from gun-fire. Injuries visible to inspection are as follows:

One 5-inch shell dismounted 37-millimeter gun on port forward bridge over sponson.

One 6-inch cut fore and aft beam over port forward gun sponson.

Seven small shells passed through forward smokestack.

Five small shells passed through forward drum room.

A large shell tore a 4-foot hole in the port side below the main deck and just abaft the port midship gun.

There is a similar injury on the starboard side, nearly opposite.

One 5-inch shell through the after smokestack.

Three 5-inch shells, close together, entered port side under main deck, abaft after smokestack.

One 6-pounder in after smokestack.

One 6-pounder in after escape pipe.

Two 5-inch entered port side between mainmast and after sponson.

One 5-inch passed through shield of 37-millimeter gun on port after bridge, over sponson, dismounting gun.

One 6-pounder cut forward part of upper edge of port after gun-sponson embrasure.

One 1-pounder cut forward vertical edge of same.

One 5-inch raked outside of starboard after sponson.

One 6-inch entered starboard side, under main deck, under midship gun.

There are two jagged holes, 4 feet and 1 foot in diameter, on starboard side under main deck, abreast after smokestack.

One 5-inch on starboard side under main deck, just abaft forward sponson.

One 5-inch through after side of forward starboard sponson.

One 5-inch through port after sponson, forward side, near deck.

Two scars of small shells on port after 16-centimeter gun shield.

Several small holes in after smokestack as if from fragments of a bursting shell.

Total, two 6-inch, twelve 5-inch, and four other large shells; three 6-pounders and sixteen other small shells; thirty-seven shells in all. Survivors tell of three 8-inch shells which burst on the orlop deck forward, amidships, and aft, causing fires which could not be controlled. This raises the known hits to forty.

Admiral Montojo states:

> The Castilla . . . had all her guns put out of action except one on the poop. . . . Riddled by shot and in flames from the enemy's shells, she was sunk and abandoned by her crew.

Survivors state that they were rescued by boats from shore which came off in obedience to a prearranged signal.

Don Antonio de Ulloa.

This vessel was not in repair on May 1, parts of her machinery being on shore. She was moored head and stern on the left of the Spanish line, in Cañacao Bay, just behind Sangley Point, her starboard broadside bearing, the port guns having been removed to be emplaced on shore. The low sandy point was expected to form some protection to her hull. She was only manned by men enough to fight her starboard battery, about half of her normal complement. She received but little gun-fire in the first engagement, but was riddled and sunk by the leading American ships in the second, and was abandoned with colors flying. She listed heavily to starboard just before settling, but righted on the bottom and lay with her poop awash, superstructure and forecastle above water. She had sent down yards and topmasts and these spars were on shore, except the fore yard, which had been untrussed but not sent down. The slings of this yard were cut during action and the yard fell across the forecastle on the sheet bits,

breaking the beam at the break of the forecastle. The other injuries visible above water are as follows:

One 6-pounder entered under forecastle from forward, passed through the midship waist ventilator and burst in front of pilot-house, near deck.

One 8-inch raking shell entered at break of topgallant forecastle just under the deck and burst.

One 8-inch burst just under the superstructure deck, port side, on line with after end of pilot-house, a long half fragment passing out through the skin of the ship.

One 5-inch came over starboard rail a little farther aft and passed out through port bulwarks.

Six 6-pounders came over same way between superstructure and poop, and passed out through hammock nettings on port side.

One 8-inch passed clean through both sides, starboard to port, just under after break of superstructure deck and near mainmast.

One 6-inch came in starboard rail abaft mainmast and passed out through port hammock netting.

Seven large shells, probably 5-inch, ripped across superstructure deck, coming from direction of starboard bow.

One 8-inch across forecastle from starboard to port dismounted starboard 6-pounder gun, cutting away the mount.

One 6-inch shell passed through the shield of this gun.

Three 6-pounders from starboard to port passed through mount of port 6-pounder gun.

One small raking shell gouged skin of ship just forward of port sponson.

One large shell ripped poop in front of mizzenmast.

One large shell cut starboard binnacle stand.

Three large shells ripped poop deck, coming from direction of starboard bow.

Two large shells burst under poop, one near break and one aft, forcing up the deck.

The left side of after 4.7-inch gun-shield and the sponson rail were cut through by a 6-inch shell.

Total hits observable: Four 8-inch, three 6-inch, one 5-inch, and fourteen other large shells; ten 6-pounder and one other small shell; thirty-three projectiles in all.

Admiral Montojo states:

> The Ulloa . . . . was sunk by the holes made along her water-line by the enemy's projectiles.

Don Juan de Austria.

This vessel was sunk by the Spaniards behind Cavite arsenal, in Bacoor Bay, about two cables off shore abreast the west arsenal gate, after retiring from battle at the end of the first engagement. She was anchored by the port anchor and sank heading east, her topgallant forecastle above water and poop awash. After being abandoned, and while sinking, she was set on fire by a party from the Petrel sent for that purpose, and burned from the after engine-room bulkhead to the stern. Her starboard guns remained trained on the bow, and port ones on the beam.

Twelve empty 6-pounder cartridge shells lay at starboard forecastle gun and nine at the port one. A full box of 1-pounder ammunition remained on starboard side of superstructure near the pilot-house.

The injuries to this vessel were as follows:

Two 6-pounders, or smaller, scarred foremast.

One 6-pounder and one 5-inch entered port side under topgallant forecastle and burst without causing fire.

One 6-inch or 8-inch passed through superstructure deck under the bridge on port side and burst in the captain's galley, causing no fire, there being no woodwork in its neighborhood.

Another similar shell coming from same direction (one and one-half points abaft the beam) struck the superstructure deck near the corner of the pilot-house, glanced up and demolished the steering wheel and gear and engine telegraphs.

Two 6-pounders passed through the pilot-house, one from port to starboard low, and one from starboard to port halfway up.

One 5-inch cut through the mizzenmast about halfway up.

One 5-inch entered under port hawse pipe and burst, damaging port torpedo tube.

One 6-pounder entered at waterway under superstructure on main deck, port side.

One 5-inch entered port hammock netting abreast the mainmast.

One 6-pounder struck the rail abaft the port after 4.7-inch gun.

No further injuries were found after the vessel was raised. Summing up, she was hit by the following shells: Two 6-inch or 8-inch, four 5-inch, five 6-pounders, and two other small shells; thirteen projectiles in all.

The Austria has two bow torpedo tubes. When raised a 14.2-

inch Schwartzkopff torpedo was in the upper starboard outboard rack abreast the tube, and another lay on the deck in rear of the starboard tube without a head.

The Austria assisted in rescuing the men from the Castilla before retiring behind the arsenal.

Isla de Luzon.

This vessel and the Isla de Cuba maneuvered together on the Spanish right flank, more retired than the other vessels, circling together at considerable speed. The Luzon retired behind the arsenal at the end of the first engagement, anchoring near the Austria, and was sunk by her own crew. Her stern settled upon a submerged wreck, keeping the cabin above water and the topgallant forecastle awash. After sinking her head lay northeast, she being about a cable's length southwest of the Austria. She was set on fire and burned by the same party which burned the Austria, the damage by fire being almost identical.

One 4.7-inch common shell, nose fuzed, remained in a rack between the after guns.

The injuries by gun-fire were as follows:

One large shell crossed her rail in wake of the two forward guns, disabling both guns.

One shell cut the chain topping lift of the fore gaff, letting the peak fall across the bridge.

The Luzon assisted the Cuba in rescuing men from the Reina Cristina before retiring behind the arsenal.

Admiral Montojo states that—

> The Luzon had three guns dismounted and some small injuries to her hull.

There seem, therefore, to have been three hits in all. No additional injuries could be discovered when this vessel was raised.

Isla de Cuba.

Admiral Montojo transferred his flag to this vessel when the Cristina was abandoned. After rescuing a part of the latter's crew she stood in behind the arsenal and was anchored by the starboard anchor a cable's length southwest of the Luzon, heading southeast. She was sunk by the Spaniards and burned by the Petrel's party in the same manner as the Austria and Luzon. Her main-battery guns remained trained on the bow. This ves-

sel used armor-piercing shells from her after 4.7-inch guns, and these being the only guns of that caliber firing armor-piercing shells in the engagement, it must have been one of these which struck the Baltimore.

The injuries to the Cuba were as follows:

One 6-pounder through the pilot-house, starboard to port.

One shell cut away both forward vangs abreast the pilot-house rail.

One 6-pounder passed through under the topgallant forecastle without exploding.

One 6-pounder glanced from left side of starboard after 4.7-inch gun-shield.

One 6-pounder struck conning tower shoulder high, but did not penetrate.

Total hits, four 6-pounders and one unknown caliber; five in all.

The Cuba showed no additional injuries when raised.

Marques del Duero.

The Duero was in action in the left wing of the Spanish line and under steam. She assisted in rescuing the survivors of the Cristina and retired like the others behind the arsenal, where she was anchored close to the shore, about 800 yards west of the Cuba, heading east, and was there scuttled and abandoned. A party from the Petrel burned her. She was entirely gutted by fire and lies with bulwarks awash. She shows the following injuries from gun-fire:

One 8-inch shell entered close under topgallant forecastle deck, starboard side, and probably exploded.

One 6-inch very close to the latter, probably exploded; there being no evidences of egress by either of these shells.

One 6-pounder passed through midship-gun sponson, starboard side, forward of gun-shield.

One 6-pounder passed through after bulwarks, starboard side, down through deck and out port side near break of poop.

Admiral Montojo reports:

> The Duero had one engine crippled, as well as her 12-centimeter bow gun and one of her sponsons.

Thus there seem to have been five hits in all.

Velasco.

This vessel was undergoing extensive repairs and lay at moorings near the east water-front of Cavite arsenal. Her main deck in wake of the boilers had been removed to take out the latter, which were on shore. A new superstructure deck had been laid, but was unfinished. She had no steering gear in place. She took no part in the action. All her guns had been removed to be mounted in shore batteries. She was sunk by the Spaniards after the first engagement and then burned by a party from the Petrel. She lies on an even keel, heading westward, with bulwarks awash, and was not seriously injured by fire. There are evidences of the explosion of a quantity of small-arm ammunition on her deck aft, probably when she was burned. She was struck by one stray shell, which crossed her stern from port to starboard, carrying away the taffrail and kedge-anchor fluke on starboard quarter.

General Lezo.

Admiral Montojo states that this vessel was under repair and not in action. After the second engagement she was found anchored in Bacoor Bay, by the port anchor about 2 cables south of the Luzon, heading south and settling. She was burned by a party from the Petrel, her after magazine exploding with great violence, as well as some ammunition on deck. Her midship guns were missing and, although she had a bow torpedo tube, there were no evidences of torpedoes on board. The elevating gear of her 9-centimeter bow gun had been damaged by a projectile. She lies with main deck about 2 feet under water.

Argos.

The Argos was a hydrographic survey vessel lightly armed and not in the fight. She remained anchored behind the arsenal about 800 yards west of the Velasco, and was scuttled by the Spaniards and burned by a party from the Petrel. She settled till her bulwarks were awash, heading east. One large shell struck her starboard bulwarks at break of forecastle, passing outward.

SUMMARY OF HITS IN EVIDENCE OR OFFICIALLY REPORTED.

Name of vessel.	Number of hits.	Remarks.
Reina Cristina	39	Probably not more than half.
Castilla	40	Do.
Don Antonio de Ulloa	33	Do.
Don Juan de Austria	13	Complete record.
Isla de Cuba	5	Do.
Isla de Luzon	3	Do.
Marques del Duero	5	Probably more.
Velasco	1	Probably all.
General Lezo	1	Do.
Argos	1	Do.
Total	141	

Of these, thirteen were 8-inch, six 6-inch, and twenty-two others 5-inch or larger; thirty-one were 6-pounders and twenty-nine others smaller calibers.

The Spanish ships had removed all light spars, slung gaffs, and snaked rigging, but they went into action without unshipping awning stanchions, ridge ropes, or canopy frames, and they carried many of their boats. They were all painted gray except the Castilla. She was still white except her gun sponsons, which were gray, and her smokestacks yellow.

The killed and wounded, as nearly as I have been able to ascertain by painstaking inquiry, were as follows:

Vessel.	Killed.	Wounded.	Total.
Reina Cristina	130	90	220
Castilla	23	80	103
Isla de Cuba	..	2	2
Isla de Luzon	..	6	6
Don Juan de Austria	..	22	22
Don Antonio de Ulloa	8	10	18
Marques del Duero	0	0	0
Shore batteries	6	4	10
Total	167	214	381

Officers killed and included in the above: Reina Cristina, captain and six others; Castilla, one; Don Antonio de Ulloa, captain and two others.

The total casualties agree with Admiral Montojo's official report.

The following points in connection with my examination seem to be brought out or emphasized:

1. The sides of iron and steel-built cruisers do not arrest projectiles enough to explode them.

2. The incendiary effect of bursting 8-inch shells is great, and far greater than would seem proportionate to that of lower calibers.

3. At ranges over 2500 yards the gun-shields of cruisers are in no sense a protection, but insure the annihilation of the gun's crew and the disabling of the gun if struck by a large projectile.

4. Warships of the present day will generally be placed hors de combat by conflagration and the destruction of their personnel before they are sunk by gun-fire.

Very respectfully,

JOHN M. ELLICOTT,
Lieutenant, United States Navy, Intelligence Officer.

To the COMMANDING OFFICER, U. S. S. BALTIMORE.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WATCH, QUARTER AND STATION BILLS.

By LIEUTENANT-COMMANDER SEATON SCHROEDER, U. S. N.

At the suggestion of the Board of Control I offer some observations upon the organization of ships of the present fashion, hoping to give rise to discussion and exchange of views.

The change from sailing vessels with auxiliary steam-power to full-power steamers necessitated immediate changes in our station bills. As a matter of course the "Topmen" had to go, and the parts of the ship were reduced without discussion to the forecastlemen and afterguard. Whether or not these two terms should be retained then became the subject of as acute discussion as any other one point.

The work aloft being reduced to practically nothing, excepting in a few small gunboats, and the gun-power becoming so very much greater, it is only natural that the energetic minds of progressive officers preserved their impetus and bounded ahead in the work of change, reaching the logical conclusion that, as the ship was built to carry the guns, the divisions should be the basis of organization. I think there is no doubt of the correctness of that principle, and I believe there are few officers now who do not assent to it. Somewhat different interpretations have, however, been put upon that apparently simple enunciation; some officers are of the opinion that to be consistent and in keeping with present conditions, the "Parts of the Ship" should no longer appear in the watch bill, being obsolete and useless; while others, less radical, are firm in the belief that those units are still of material use and convenience and should be retained. In one ship that I know of, a few years ago, the desire for change had

been so powerful as to even do away with the starboard and port watches. That was, however, a sporadic case.

In the old sailing ships, including the auxiliary steamers immediately preceding the "New Navy," it was a matter of positive regulation, based upon sound principles, that the whole of any one gun's crew should never be drawn from one, nor even from only two, parts of the ship; without that precaution the destruction of one gun's crew might seriously cripple the part of the ship from which it was drawn, an important circumstance when sail might have to be suddenly shortened to a squall, or as quickly made in chase or retreat. As a consequence, a mizzen-topman would be seen temporarily fraternizing with a forecastleman at quarters, although each knew well that in the morning watch the other would exercise a considerable amount of discretion in heaving salt water and sand over his bright-work. Now, of course, that conflict of interests no longer exists. In fact, official suggestion is the other way. The leading paragraph in the Gunnery Drill Book for the New Armaments reads: "In distributing the petty officers, seamen and others to the guns and other stations in the several divisions, it is deemed advisable as a general rule * * * * that those stationed at the same gun or near each other at quarters should, as far as practicable, be drawn from the same part of the ship where their association has already been close." No other distribution would be tolerable at present. And the first immediate result is that (say in the Massachusetts) all of the first division are in the forecastle. Natural result, first question: "Why not call them simply first division?" Answer: "All the forecastlemen are not in the first division; there are others."

To provide for the efficient performance of the different characters of service, different units are created; we have boats' crews for boat work, companies for infantry drill, platoons for artillery, messes for eating, guns' crews for working the battery; it is certainly in line with that general plan to have parts of the ship for ship work. The guns are undoubtedly the *raison d'être* of the ship; children are the *raisons d'être* of mothers; but the ship, the mother that bears the guns, should not be neglected. Furthermore, as mentioned above, all the forecastlemen are not in the first division, nor are all the afterguard in the fourth; the navigator's division and the powder division have to be provided, and they are not and cannot be composed wholly of quartermasters,

gunner's mates and other petty officers; the other men in these divisions must have some station on deck for coaling or cleaning or painting ship, hoisting boats, handling hawsers and awnings, and general deck work. The number of men in these two divisions is considerable, and should be still greater; and there is hope that it may be greater in future ships having more berthing space, as a recent station bill board, of which I was a member, recommended that the complements of ships should be such as to permit an entire powder division without drawing upon the engineers' people. This matter lies perhaps more with Congress than with the Department. In the navigator's division men are required in excess of quartermasters, for many duties—at least four in the steering engine room in case the deck wheels or steering engine are disabled, others for the search-lights, signalmen, messengers, range-finders, etc. Some of these requirements were recognized early in the Massachusetts, but it is astonishing how the possibility of meeting an actual enemy brings such necessities to mind. With so many extra people to be stationed on deck, it leads to confusion to call the first division, for instance, for ship work, when you also want all those of the navigator's and powder divisions who have ship duties on the forecastle, or to call the fourth division for gun work and explain that the navigator's and powder divisions need not answer.

Before joining the Massachusetts, I had considered suggesting to the captain the plan of having three parts, being prepared to give the good old name of waisters to the men who would live, move and have their being on the central upper deck; but the number of men required for the four eight-inch turrets and twelve six-pounders located there is conveniently divisible into two divisions, and parts of the ship, of about the same strength as the first and fourth divisions; so the first and second parts of the forecastle, and the first and second parts of the afterguard were adhered to, comprising respectively the 1st, 2nd, 3rd, and 4th divisions. This distribution of the men has worked satisfactorily in this ship for nearly three years, and coincides with the recommendation of the station bill board referred to, which has, I understand, been approved by the Bureau.

If I had it to do over again I would have four parts of the ship, distinctively and separately named, as being more convenient; waisters, upperdeckmen, casematemen seem adaptable terms. In

smaller ships, or ships without an upper deck, it may not be necessary to subdivide the parts, particularly as there may only be officers and men enough for two divisions. It may well happen that a distribution into three parts will be conveniently adaptable to certain types of ships, possibly also harmonizing with three gun divisions. The principle of parts of the ship being accepted, it would be well to allow this amount of latitude as to the number of parts in preparing a general scheme for the entire service; although, of course, uniformity is desirable where it does not cause inconvenience or diminished efficiency.

The question as to whether the navigator shall have a division or a detail is of no great moment; the latter practice would relieve that officer of the trouble of making out clothing and money requisitions and inspecting bags and hammocks, and would put it on some one else; for infantry and artillery drills, his men would join their companies in either event; and for battle, collision, and fire quarters they have their own special duties with the chief boatswain's mate and chief quartermaster under the navigator, and it undoubtedly tends to increased efficiency for them to always muster together and know each other and realize that they have duties, and important ones. So there seems to be good reason why this unit should constitute a division.

Watch Bill.

The general plan of stationing the men being decided upon, the watch bill works out easily and logically. In this, as in all steps in organization, care should be taken to minimize the necessity of efforts of memory. Nothing can be simpler in this matter than to have the various groups or units each tally with a certain hundred; the 1st part of the forecastle, comprising the 1st division, should take the one hundreds; the 2nd part, the two hundreds; 1st of afterguard, comprising the 3rd division, the three hundreds; and so on. This leaves the numbers from 1 to 100 unappropriated, and a divergence from the old custom of making the captain of forecastle No. 1 appears desirable; instead, the petty officers should come first, beginning with the chief master-at-arms. It is in the interest of convenience to place in this group all petty officers, excepting those who stand watch with their part of the ship, and excepting the petty officers of the engineer branch, who should be grouped with the other people of that branch.

The marines can be put in to occupy the numbers between 500 and 599; and if the number of these, and the scarcity of sailors, and the arrangement of the battery, be such as to permit stationing them as a unit by themselves, they may comprise the 5th division. There are now so many marines found on board that it is generally necessary that a good many be put elsewhere than in any one gun division; some will inevitably have to be grouped with naval people. It is a matter much to be deprecated that the circumstance of these gallant men being of a separate and independent corps, wearing a different uniform and unable to perform seafaring duties, introduces serious difficulty in fitting them into the ship in such way as to produce useful results. The best solution will probably be found in putting some in the powder division; and the officer of that division may, in some ships, find it convenient to station them in such manner that they shall serve ammunition to guns manned by other marines; but such special arrangements are not generally practicable nor commendable, and having thus to harmonize discordant elements creates a difficulty which would not exist if the simple, natural law were followed of letting soldiers constitute the army and sailors constitute the navy. With our limited complements, sentiment, while duly respected, must give way to exigencies of an exacting service, and every man must be put where he will be of the greatest value, mixture of uniforms and traditions to the contrary notwithstanding. The men who organize, handle and fight our ships and are directly and wholly responsible for their efficiency in peace as well as in war, would hail with great satisfaction the existence of but one uniform, one fraternity, one service, one past, present and future history.

Next comes the engineer branch, or whatever it may be called under the *fin-de-siècle* organization imposed by the *personal* bill; and in watching these, a departure is suggested from what has been a general custom. Instead of attempting to watch them according to their steaming divisions (or sections, as they should preferably be called), which would constantly be changed, it is recommended to put their petty officers in the 600's, firemen in the 700's, and coal passers in the 800's. The reason for that is this: When a ship goes to sea, the men of this branch are necessarily changed around in their steaming sections by the chief engineer to meet conditions and requirements which are

constantly changing, owing to the greater or less number of boilers in use, to some men being on the sick list, to special details for outside stations such as blower engines, evaporators, ice machines, etc. It is impossible to change their watch numbers each time, and the result is that any attempt to watch them according to their steaming sections becomes a dead letter. The method proposed is in operation on board the Massachusetts, and works to the satisfaction of all concerned.

The messman branch comes next, and, as fifty numbers are ample, they can be put from 900 to 949, leaving 950 and above for the bandsmen in a flagship.

The powder division, as may be noticed, is not distinctively numbered in any group of a hundred in this scheme. Being composed of men belonging to so many other groups—petty officers, seamen, coal passers, mess attendants, etc.—that would manifestly not be in accordance with the governing theory, and to attempt it would make the entire plan inoperative; there is no one part of the ship to which they could all belong. The same applies to the navigator's division.

In a bill framed in this manner, there is no watch number of over three figures. Even in vessels so small as to have only two gun divisions, and no 2nd parts, it is as simple to number the firemen's bags and hammocks 700, and mess attendants' 900, as 400 or 500; and where it produces no actual inconvenience, uniformity is a good thing, and the numbering suggested above appears well suited to ships of all classes.

In some ships the method of watch numbering has been refined down more than suggested above; and there is much to commend this method as applied in those ships. The organization is in divisions and parts of divisions; the first digit of the watch number indicates the division; the 2nd, the part of division; the others, the number in the part. For instance, No. 42 would indicate the 2nd number in the 4th part of the 1st division; No. 4112, the 12th man in the 1st part of the 4th division; No. 8332, the 32nd man in the 3rd steaming section of the engineer's division. Certain chief petty officers and petty officers first and second class have letters instead of numbers. Incidentally it will be observed that the watch is indicated by the 2nd digit, the starboard watch of the different parts being called the 1st and 3rd parts, and the port watch, the 2nd and 4th parts. At the

first inception of this idea I understand that the plan was to extend it so that the gun number should be indicated in the watch number; but this suggestion cannot be too strongly condemned; the division officers should be free to station their men according to their capabilities, which they can determine much better than the executive officer or any one else; they should be furnished with a list of their men, and be at liberty to put them at any gun and in any station that they consider them best fitted for; and as changes are very apt to be frequently made in the interest of efficiency, such changes should certainly not entail changes of watch numbers, carrying with them changes in bags, hammocks, boats, and possibly messes.

Objection has been raised to this method as at present carried out, on the ground that the information contained in the 3rd and 4th digits is valueless; but this cannot be considered a very valid objection as long as nothing in the way of simplicity is sacrificed in imparting such information. An objection which can be urged with some force is that some of the watch numbers consist of four figures; the use of letters also seems a pity; also, the 2nd digit must be misleading in the engineer's division, because even if the plan of watching them by steaming sections be followed, those sections will exist only on paper, and the 2nd digit will give no correct clue to the man's actual watch-standing section; lastly, it seems more simple to have the watch indicated by the last figure.

Incidentally it will be observed that the application of this method to an organization containing parts of the ship will call for four such parts, each being further subdivided into two watches; this will facilitate the setting of quarter watches. Applied to the bill recommended in this paper, the 2nd digit would have no function, because in each division there is only one part, divided into two watches; the 2nd part of the forecastle, for instance, comprises the 2nd division, and in it all watch numbers begin with 2. At the same time an equally minute subdivision does practically exist in the Massachusetts, each part of each watch being in two unofficial sections; and during a certain period in last spring quarter watches were kept at the guns, formed of those sections. Standing quarter watches is, however, not of frequent occurrence, and it is perhaps a question if a more efficient quarter watch would not be formed by, for instance, the port watch of the

1st and 3rd divisions, relieved by the starboard watch of the 2nd and 4th divisions, rather than by half of one watch of each of the four divisions.

Messes.

The subject of messing is an important one. It is assumed that the general mess system will remain; the restriction is onerous that only 25 per cent. of the rations shall be commuted, still, no one who has been shipmates with it would ever consent to going back to the old way. The formation of messes, however, is none the less necessary. The experiment has been tried of accepting the term "General Mess" in its widest meaning; namely, to the effect that any man can sit down anywhere, at any table; but I have been told by one executive officer that he had found this to be a failure. It certainly seems rational to suppose that it would be so. If messes are formed from the parts of the ship (or divisions), the men of that part continue to be thrown together, and get to know each other better, and this must conduce to increased comfort and good table manners. The galley cooks, who are responsible for the issue of the meals in fair proportions to the mess cooks, must positively know beforehand the strength of the different messes; and unless the same number of men always sit at each table, no equitable distribution of food is possible. Also, if arranged in permanent messes, it is better known to the mess cooks (who are drawn from the same part) if men are away in boats or on watch, and better arrangements can be made for saving their meals or serving them ahead of time.

The chief petty officers, of course, mess by themselves, and it is better to except them from the general mess. For most reasons it is also better that the petty officers, 1st, 2nd and 3rd class, should mess by themselves. Objection is sometimes made to this on the score that petty officers should mess with unrated men to preserve order; but this does not appear to me to be important and it may make the other messes too large. Enlisted men are apt to be trustworthy just as far as they know they are trusted. In the Massachusetts, petty officers are not present at other messes, and offenses against table manners have been extremely rare. Still, letting the coxswains, or some of them, mess with their parts of the ship may be desirable, and it may be a means of equalizing the sizes of the messes. An eye should be had to this, of course, to equalize the work of the mess cooks and

to facilitate the distribution of food at the galley by the galley cooks. In this ship it was found convenient to put some of the 3rd-class petty officers, or people like the seaman in charge of hold, jack of the dust, barber, etc., in the 2nd-class mess. As a rule, these petty officers' messes chip in and give their mess cooks half a ration or something like that, but as it amounts to very little per man, and as they all do alike in that respect, no hardship is worked to a 3rd-class man by putting him in a 2nd-class mess.

An exception may well be made in the case of the marines, all of whom (non-commissioned officers and privates) mess together, excepting the 1st sergeant; and this appears to give more satisfaction than messing the non-coms. with the other petty officers.

The only practical way to mess the firemen and coal passers is by their steaming sections, which change every time the ship gets underway; the sections going on watch must have their meals ahead of time, and to arrange this for parts of three messes would make confusion. In the actual working, the chief master-at-arms is furnished with the lists each time by the engineer's yeoman. The ability to arrange shifting messes in this limited way is one of the many incidental advantages of the general mess system.

Powder Division.

In organizing the powder division with the comparatively light crews furnished our ships, it is generally necessary to draw from the engineer's people in order to have a strong enough force to do the work. Every consideration of efficiency demands that this contingent should not be a shifting detail, but a permanent one. With the exception of a few mechanics to attend turret-training or other engines within the limits of the powder division, the work devolving upon the detail is entirely a manual labor, requiring strength and endurance; it is not necessary that oilers or water-tenders or other skilled men should be taken away from their legitimate and important duties in the engine and fire rooms; coal passers should be assigned, and certain ones permanently detailed by watch numbers. It has been argued in opposition to this system that when steaming, a certain number of coal passers will always be on watch, and they will be dirty on getting to their stations. The force of this is undoubted; but in a fighting ship everything should be subordinated to fighting

efficiency; with a permanent detail, the officer of the powder division knows his men (not only for battle, but also for collision and fire), and they know their duties and have but the one thing to remember, and that is to get as quickly as possible to their one station when the calls are sounded. With a shifting detail, with the calls sounding near the time of relieving a watch, the men might be in doubt as to which station to go to; and the division officer has to make out a triple bill, and have a game of three-card monte to find out which detail would come.

In turret ships it may be expedient to have the ammunition supply for some of the turrets controlled and effected by these turret gun divisions, independently entirely of the powder division. This has been the case on board the Massachusetts for the 13-inch turrets, with the farther result that the 1st and 4th divisions have in that way been brought up to the strength of the 2nd and 3rd, whose 8-inch turrets are supplied by the powder division. The construction of the ship is such as to make this arrangement practically unavoidable, as the 13-inch magazines, shell-rooms and handling rooms are quite isolated from the regions inhabited by the powder division, and the officer of the latter division would be wholly dependent upon the turret officers for efficient control.

A central station messenger service, composed of active, intelligent and clear-voiced men or boys, will be found of almost absolute necessity; and they and the man in charge of the central station should, of course, be in the powder division. This service will require about four messengers in a battleship or large cruiser—at least until our means of interior communication are considerably improved.

Care of Double Bottoms, Compartments, Etc.

The care of the double bottoms, empty cofferdams, etc., may very properly be distributed among the various divisions, in such a way as to equalize the work as far as possible, assigning to each the compartments best located relatively to it. As an illustration, the allotment in the Massachusetts is as follows: The 1st division has the forward trimming tanks, the double bottom just abaft them, and the two forward cofferdams on each side below the side armor; the 4th division, the after trimming tanks, and two after cofferdams on each side; the 2nd and 3rd, the cofferdams between the 1st and 4th divisions; powder division, three

double bottoms under the forward magazines and shell rooms; engineer's division, the double bottoms under their part of the ship.

It does not appear necessary nor desirable to station men regularly for this; the division petty officers, under the approval of the division officers, consider that work a sort of permanent "call," and put men at it whom they excuse from answering other calls; in this way the routine is quickly established, and the results are satisfactory, and the petty officers get just that much more opportunity for the exercise of discretion and the assumption of responsibility—something still very much needed in our service.

The plan has also been found convenient and efficient of charging the orlop deck patrol with the cleaning of the ammunition passages, making the detail sufficiently large to carry out both the police and military duties of that post.

Collision, Fire and Clear Ship for Action.

In preparing the different bills for executing the various evolutions or meeting the various emergencies, the fundamental principle is now undoubtedly recognized that the divisions are the basis of all organization. This carries with it the corollary that the men should at all times be commanded by the same officers.

Next to not having enough men to perform a certain duty, the worst condition is in having too many. Whether at collision quarters, fire quarters, or clear ship for action, every precaution must be taken against congestion of men or material. When the Navy was first confronted with water-tight doors and hatches and with the problem of closing them expeditiously, it is possible that the importance of the evolution suggested stationing more men for that work than was afterwards found advisable. All doors and hatches cannot be closed at once, because in every group the men who close the remote ones must have an exit through the nearer ones, which therefore must be kept open for them. If, therefore, plenty of men are detailed for the remote ones, so that no probable contingency would leave them unattended to, the nearer ones will always have more than enough. The powder division, and the engineer's division, each in its own bailiwick, will probably always be found strong enough to provide for every contingency below, and no one else should be permitted there.

While on this matter of the number of men necessary to close heavy armored hatches, which are usually the final ones in each group, it is somewhat germane to the subject to allude to the dangerous proposition to provide mechanical appliances by which these can be dropped or closed very quickly by one person, thus hastening the completion of the evolution—at the cost of probably defeating entirely the object sought. If the men who are stationed to close the remote doors and hatches know and appreciate that one person, intelligent or the reverse, could close the near ones on them, there would be but one result: the remote ones would remain open. Station bills must be made out with strict reference and deference to human nature. No appliance should be allowed on board (a big ship at all events) by which it would be possible to close the armored hatches in less than about two minutes; this is imperatively demanded for the safety of the ship, as otherwise no organization could prevent possible disaster with human nature as it was in the beginning, is now, and probably ever shall be.

At a fire the tendency of a man with a nozzle is to rush at it, and dangerous crowding may result. The number of available streams is so large in every part of the ship that it was found advisable to insert in the fire bill of the Massachusetts the following: "But no hose shall be led below from the main deck, and no man from the gun divisions shall go below the main deck for gratings or for any other purpose until a special order to that effect is given by the executive officer, officer of the deck, or officer of the powder division. And the officers of all divisions will carefully prevent any undue crowding, confusion or congestion of lines of hose, * * * ."

In clearing ship for action also, the powder division should be left alone to receive all material passed below, and stow it where designated, and to do all work of preparation below. On deck the division officers are responsible for the complete preparation of the parts of the ship where their divisions are located. In the engine and fire rooms the chief engineer is likewise responsible and should not be troubled. If coal has to be trimmed down from upper to lower bunkers, each division should send a party down, and the number of men for this should be stated in the general bill. Too much centralization is to be deprecated. The nature of the work of clearing a ship for action is such that any attempt to do the various things by watch num-

bers would prove fruitless; the station bill should state clearly and precisely everything that is to be done by each division, and each division should then be held responsible.

Boats and Battalion.

Finally we come to the boat bill and the landing organization. There is some difference of opinion in the service about these; but I am under the impression that the majority of officers favor adhering to the excellent rule that, so far as is possible, the divisions shall continue to be the basis, and that the officers shall always command the same men, ashore as well as afloat. The argument advanced by those who are opposed to this is that if a couple of boats' crews, or a company, should be away, the division from which they are drawn would be crippled, and that the ship would be left in a more defensible condition if they were drawn in small numbers from all the divisions. On the other hand it is urged that two complete divisions, for instance, are more reliable and more efficient than four half-manned ones. What appeals very strongly to me also is the conviction that when any evolution is to be performed, from furling awnings to landing the battalion, the organization should be such as to best ensure the success of the evolution rather than a superior condition of affairs in no wise connected with the prime object in view.

Even if the principle of diffusion prevail, it will be limited in its application, because its strongest advocate will probably not recommend carrying it to the logical point of sprinkling the marines among the other companies; this is interdicted by the difference of uniform and inharmonious *esprits de corps*. Having thus to stop short at an incomplete phase of organization shows again a vital defect in administration—an obstacle in the way of perfect efficiency. If any one blue-jacket company be short of full strength, files can be added from any other blue-jacket company, but not from the marine; if the marine company were short, it would have to remain so, or if the number of files in that company would just fill the other companies, they would still all have to go in that depleted condition because of the co-existence of two organizations which cannot mix—an unfortunate heirloom from bygone conditions. When the time shall come that the error is recognized of expecting men to perform well the widely differing duties of two wholly separate and distinct professions; when one professional engineering establishment shall exist, and

one professional nautico-military; when there shall be but one uniform worn on board of our ships; and when all military officers shall share watch, boat, division and double bottom duty, so as to leave no one unemployed;—then will we have an ideal correlation of forces which shall indeed make the modern warship a triumph of mind over matter, and the handling of its powers a tribute to the value of organization.

> Chacun à son métier;
> The cobbler to his last,
> The gunner to his linstock,
> And the cook to the foresheet.

By stationing men in the boats which hang abreast of their divisions and their parts of the ship, the boats will naturally be better taken care of, and the men will man them more conveniently; and the officers being stationed in the same way will keep them and their men together. A convenient plan is to detail all the men in any one part of the ship for those boats; when called away, the officer of each boat takes only the number specified for the designated service (distant service or cutting out). In abandoning ship the men should go in the same boats as at arm and away; and the rest of the ship's company will have to be divided among all the boats according to their capacity. Dinghies' crews will presumably never arm and away, although men are stationed in them; the supernumeraries in the companies are enough so that, in the improbable event of forming companies when away for "cutting out," there would still be enough men from each division to form its company without the dinghies' crews.

The vast majority of cases of landing the battalion would be under circumstances which would permit, and in fact call for, simply transporting the companies in boats loaded to maximum safe capacity, and towing them ashore with the steamers. This need not appear in the station bills posted about the ship, nor in the men's station billets, as it is quite unnecessary to add to the efforts of memory. In practice, when the battalion is to be landed, the adjutant's call is sounded, the companies are formed, and the officers are notified, or reminded, in which boats to embark their companies and detail boat-keepers.

In order to save efforts of memory, it would be well for the running boats' crews to be the same as for arm and away and abandon; but in practice this is almost impossible. In a heavy

ship there are some fifty men with regular stations in armed boats, who are on special details of ship duty which prevent their being in running crews; these details comprise mess cooks, messengers, signalmen, dynamo boys (for instruction), store-room keepers, etc. If the rigid rule were adopted that running crews should be the same as arm and away, then, whenever a man in a running boat was made a mess cook or signalman, etc., it would be necessary, in order to put him in a launch or some infrequently used boat, that his watch number should be changed, frequently to the extent of changing his division, which would be injudicious in its bearing upon the efficiency of the division; and the amount of work in shifting bags and hammocks for all these frequent changes would be very great. As a matter of fact, not the slightest difficulty or confusion arises from having the running crews separate and distinct. The coxswains, of course, are the same for all kinds of service. And there is no practical difficulty in having the gig's crew likewise the same; it is well as a rule to handle the gig's crew very tenderly, and as they do not take their turn with other men on special ship details, they can be assigned by watch numbers; this is made easier by having them all of the same rating—apprentices, for example, who make a very good gig's crew.

I have heard of an entirely different system of routine boat duty, the advantages of which are not patent to me. This consists in having no crews at all, but in making out a working party each day of a certain number of men who will stand by and man any designated boat. It is evident that such temporary details can have no interest in their boat, either cultivated or enforced, and the coxswains must have a hard time keeping the boats clean and property intact.

Regarding the companies and platoons, the increase in their strength by the last drill regulations complicates the problem slightly. In the largest ships in the service, with the complements that it is possible to give them now, the divisions are not strong enough to form complete companies of fifty-four each; considering the number of boat-keepers and probable absentees, companies thus formed would be very rarely full. In the Massachusetts, since receiving the new order, the junior division (the 3rd) has been broken up and distributed among the other companies, making four large units. By this arrangement the 2nd, 3rd and 4th companies are each some 15 or 20 men in excess,

who are available for boat-keepers or are left on board. In case of dire necessity these remnants could be collected and sent off as a reinforcement under the command of the junior division officer, forming a complete company possibly, if the ship's complement were full and no sick list. But the regular organization thus forms a full battalion of four companies, the marines being the 1st. If legislation should permit a slight increase of complements in the future, five complete companies could be formed in ships of this class.

Suggestions.

Following is a suggestion for a watch bill for a ship of the Massachusetts type, with her present complement, the watch numbering being in accordance with the report of the station bill board. At the end of the paper are also summaries of the various station bills which appear to be successful in this ship.

I apprehend that it may be suggested in criticism of the watch bill that the parts of the ship appear to be the foundation and comprise the divisions, instead of the reverse. This is not really the case, as may be seen from closer examination. The larger unit must comprise the smaller; it is more convenient to follow this form, in which, for instance, all the 1st division can be seen at a glance (except a few petty officers), and all the forecastlemen also, than to have only a division on each page, and to have to pick out the forecastlemen from the navigator's and powder divisions as well as from the 1st. All the station bills are made out by divisions, and not by parts of the ship, and therefore the quarter bill is absolutely the foundation in fact as well as in theory.

It will be observed that in each group of 100, the various ratings are grouped in individual tens or twenties according to the number allowed; this is in the interests of uniformity and convenience. The watch numbers of the coxswains are so arranged as to bring them nearest to their boats as located in the Massachusetts; and the leading petty officer in each part is the one least apt to be called away for boat work. In these matters, of course, ships differ, and regard must be had to the boat stowage in each case.

The messes are made out simply according to the ratings, and, as suggested in the body of this paper, variations to suit individual complements will be desirable for the purpose of equalizing their

strength. Putting all the coxswains in other messes would reduce the 3rd-class mess to 20, which is rather small, and would raise No. 6 mess, for instance, from 26 to 28; whereas taking out the captain of hold, jack of the dust, barber, and hospital apprentices would reduce the 3rd-class mess from 32 to 27, and raise No. 3 (2nd-class) mess from 15 to 20.

The column "Actual Rate" is of great convenience to keep the ratings straight; as, for instance, the number of landsmen is apt to be largely in excess of complement, and the seamen correspondingly short; or several gunner's mates, 3rd class, may be present in place of gunner's mates, 2nd or 1st class.

The entries in the column "Special Detail" are not as a rule dependent upon the corresponding watch number; they would be entered in pencil in the ship's bill, and are only given here as an indication of the probable requirements.

The principal points which will naturally assert themselves in dividing the battery into divisions are: facility of supervision by the division officers; minimum variety of classes or calibers in any one division; ammunition supply; maintenance of divisions of equal strength; equitable and symmetrical distribution of routine ship work. The ammunition supply of heavy turrets is apt to be more easily supervised by the turret officers than by the powder division officers, and the natural resulting propriety of putting the men who do that work in the gun division may further assist in equalizing the strength. Following the rule that men should be assigned to guns located in their own part of the ship, if any guns are given to the marines, they should be, if possible, in some one part of the ship that they can take care of, and for which the work will not call for any knowledge or skill other than that which they are called upon to possess. In the Massachusetts they have the main deck inside the casemate, manning the guns there (four 6-inch and two 6-pounders), and helping keep that part of the ship clean. There being more than required for that battery, a certain number are detailed for the powder division; but the casemate is their part of the ship, the police corporal being responsible for the proper condition of the paint work under the general supervision of the master-at-arms, 1st class, in the same way that the captains of the forecastle and afterguard are responsible under the boatswain's mates, 1st class.

In many ships it may be found that a logical assignment will result in some one part of the ship having a larger amount of

work in cleaning and general maintenance than some other. In this case the gun divisions should still be kept as nearly as possible of equal strength (on account of boats, companies, etc.), and the necessary increase in the strength of the corresponding part of the ship made up by putting most of the navigator's and powder divisions there.

At arm and away no boat should carry people of more than one company. It will be observed that in the suggested watch bill this is the case except in the 3rd division, which is split up into different companies, and the sizes of boats of that division in the Massachusetts are such that one boat has unavoidably to carry parts of two companies. Before the increase in the size of companies this was not necessary.

In laying off the watch bill in the book, it is well to leave blank lines between groups of ratings, to provide for the contingency of the complement being changed, or of having additional men on board temporarily for passage or special duty.

It will also be found to be a great comfort and convenience to keep in the front part of the book numbered lists, corrected to date, of the men grouped in their ratings, so as to tell at a glance what vacancies or excess exist in any rating. For example:

Boatswain's Mates, 2nd Class, 4.

1. Patrick Kinneavy.
2. Henry Delin.
3. Samuel Shelton.
4. .....

This shows one vacancy in this rating. Or:

Landsmen, 34.

1. Timothy Grass.

* * * * * * * * *

35. Hay Seed.
36. Red Clover.

showing two landsmen in excess.

The figures in excess of the number allowed should be in red ink, appealing immediately to the eye. Occasional verification of these lists by comparison with the watch bill will save much trouble; without this precaution it may some day take several hours of examination to reconcile the weekly report of vacancies.

Of the signalmen, two should be in the navigator's division, for the reason that they would have the skill due to practice, and

have more familiarity upon relieving those on watch; the same two would conveniently constitute the signal squad of the landing force. It is worth while to change watch numbers to effect this. It would, in fact, be well to have all six signalmen in that division; but this will not be found easy to keep up in the North Atlantic Squadron, where changes in ships' companies are so frequent; on a foreign station it can be done without serious inconvenience.

The three seamen who stand watch in the steering engine-room at sea, including the one who has charge of it, would preferably also be in the navigator's division; in case of quarters, especially at night, the one on watch will then not have to leave his station to go to a gun. They have no connection with the powder division, and are wholly beyond the jurisdiction and control of the powder division officer. The training and practice (weekly at the very least) of these men, and in fact of the whole division, in connecting up with all the different points of control and for the different applications of power, are under the immediate instruction by the chief quartermaster and navigator.

The special details of gunner's mates should be by watch numbers, as their battle stations depend upon them. The four electricians at present allowed (though not yet provided) in the complement are not enough; the chief has too much to do to stand watch, and they should not be in less than four watches, for it must be remembered that the dynamo room is always hot, and these people do not stand watch only when at sea like the engineer's people, but are at it every day throughout the year; a gunner's mate has therefore to be added to the dynamo room party. The two apprentices marked as under "Dynamo Instruction" are almost a necessity, to help the chief electrician in the care and maintenance of fuses, circuit breakers, lamps, portables, motors, etc., beside cleaning the storerooms; incidentally they pick up a good deal of information and become useful assistants.

In some ships I understand the search-light crews have been drawn from the dynamo people; but I see no necessity for that, nor any advantage; it does not take an electrician to handle a search-light, and the electricians are needed for the dynamos, circuits, ammunition hoists and other motors, and should be in the powder division. In some instances, also, the dynamo people have been in the navigator's division; but it seems more rational to have the powder division include all men who are stationed

where that division officer can control them. It is true that the navigator is in charge of the electrical outfit, but he could certainly not go down into the bowels of the ship in action to attend to dynamo troubles.

A large ship requires eight side-cleaners; and it is best to detail seamen or ordinary seamen for that work. They cannot well be kept in running boats, and therefore landsmen should not be detailed, because these should get all the practice possible in boats as well as at the battery. While the work of the side-cleaners is supposed to be finished before quarters, still, when the days are short, they do not manage to get through, or rather they do manage not to get through; do what you will, those briny *demi-mondains* do contrive to escape some drills.

It may be convenient to make one of the bag-room keepers lamp-trimmer; there are plenty of applications for the extra pay.

In the commissary department the chief yeoman should be a man of the steward class (it would indeed be better if his title were ship's steward); being in general charge, he has control of the galley cooks, two of whom will be required in the bakery and should be specially selected for that. Then, to look out for the storeroom and canteen, a reliable landsman may be needed, or possibly one of the galley cooks may be spared for it; at all events, one man will be enough if the order prohibiting the issue of beer remains unrescinded.

The one marine in the gig at abandon ship is the captain's favorite orderly.

The engineer crews of steamers are apt to be specially selected and more or less permanent, and they should be so if possible; and the same crews should go for arm and away; it is therefore better not to attempt to station those two men by watch numbers in those boats.

The selection for chief petty officer of the battalion will, of course, depend upon the personalities of the available men. The chief boatswain's mate and chief gunner's mate are most apt to be well adapted.

The man in charge of the central station in action and at "all hands" should also be especially chosen, as he should have a cool head, a clear voice (with American accent), a knowledge of the ship, and familiarity with the significance of all messages which might be sent through the station. As the desired qualities may be found in a non-com., or yeoman, or exceptionally

reliable apprentice, it is not a detail that can be made by watch number.

For convenience in reference at any time, as well as to constitute a system of checks which are as desirable in this as in all bookkeeping, corrected lists of all special details should follow the watch bill in the book, the watch numbers and names being filled in in pencil where the detail is not permanently dependent upon watch numbers: Messengers, signalmen, dynamo party, mess cooks, side-cleaners, captains of head, berth deck sweepers, battalion details (color guard, pioneers, etc.). Then bring in the navigator's and powder divisions, collated by watch numbers in ink, but with stations in pencil, so as to be free to change; then the boats' crews, one on a page: Running crews, with numbers and names in pencil; arm and away crews, by watch numbers alone in ink; and the additional detail for each boat for abandoning ship, by watch numbers, in ink.

In preparing the various station bills for distribution in frames about the ship, there is a certain temptation to make out combination bills which shall give in more or less detail the station of every man for every evolution; this is done in some ships the mere mention of which would carry weight and even conviction. In the Massachusetts, however, that method was given up, and two blue prints each are posted of the collision bill, fire bill, clear ship for action bill, and boat bill. The first three are given just as they stand in the book; all men specially stationed, being given their stations by the division officers, can at any time refresh their memory by looking at these bills, which are blocked off in divisions; and, while a man has to look through his division to find his number, which takes him longer than if arranged by numbers in tabular form, yet he gains by unwittingly seeing how many other men and what men are grouped with him at a certain door at collision quarters, or a certain line of hose in case of fire. This is especially of service to the petty officers. The posted boat bill consists simply of double columns giving the arm and away and the abandon ship crews, arranged by watch numbers in numerical order, for each boat; so it is easy for a man to find his own number and at the same time see who is with him; and the coxswains can verify their crew lists at any time. The running crews are, of course, not posted, as they are continually changing from month to month or oftener.

PETTY OFFICERS.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
2		M. at A. 1st C.		Pow.		2d Launch.		2	Main Deck.
4		M. at A. 3d C.		"	2d Steamer.	3d Steamer.	Col.	4	Berth. Deck.
12		Chief Yeo.	Equip.	"		2d Steamer.		1	
14		"	Capt. Writer.	"		Gig.		1	
16		Yeo. 2d C.	Nav. Writer.	"		3d Cutter.		3	
22		B. M. 1st C.		2	2d Whale.	2d Whale.	4	2	Upper Deck.
24		"		4	4th Cutter.	4th Cutter.	3	2	Q'r Deck.
32		G. M. 1st C.		Pow.		2d Steamer.		2	Torpedos.
34		"		4		2d Steamer.		2	Sec. Battery.
36		"		4		Gig.		2	
38		G. M. 2d C.		2		2d Launch.		3	
40		"		3		3d Dinghy.		3	
42		"		2	2d Steamer.	2d Steamer.	Ord.	3	Sec. Battery.
44		G. M. 3d C.		1		2d Cutter.		4	
46		"		4		2d Cutter.		4	Store Room.
48		"		2		1st Punt.		4	5th Div. Battery.
52		Elec. 1st C.		Pow.	2d Steamer.	2d Steamer.	Ord.	2	
54		Elec. 2d C.		"		3d Launch.		3	
62		Chief. Q. M.		Nav.		2d Launch.		1	
64		Q. M. 2d C.		"	2d Steamer.	2d Steamer.	Col.	3	
66		Q. M. 3d C.		"		2d Punt.		4	
72		C. M. 1st C.		Pow.		Gig.		2	
		Shipw't.		"	2d Steamer.	2d Steamer.	Amb.	4	
		B'ksmith.		"	1st Steamer.	1st Steamer.	Pion.	2	
78		Sail M.		"	2d Steamer.	2d Steamer.	Amb.	2	
80		Paint.		"		4th Cutter.		4	
82		Lds.	Barber.	"	1st Steamer.	1st Steamer.	Com.	4	
84		Bugler.		Nav.	2d Steamer.	2d Steamer.	Bugler.	4	
92		Hosp. App.		Surg.	2d Steamer.	2d Steamer.	Amb.	4	

PETTY OFFICERS.

STARBOARD WATCH.

No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
1		Chief M. at A.		Pow.		1st Steamer.		1	
1		M. at A. 2d C.		"		1st Launch.		3	Main Deck.
1		Chief Yeo.	Com.	"		1st Launch.		1	Central Station.
1		"	Pay.	"		1st Launch.		1	
1		Yeo. 1st C.	Ship's Writer.	Nav.		1st Cutter.		2	
2		Chief B. M.		Nav.	1st Steamer.	1st Steamer.	Chief P. O.	1	
2		B. M. 1st C.		1	2d Cutter.	2d Cutter.	2	2	Forecastle.
2		"		3	2d Steamer.	2d Steamer.	Col.	2	Bridge. Deck.
2		Chief G. M.		Pow.		1st Launch.		1	
2		G. M. 1st C.		"		1st Launch.		2	Torpedoes.
2		"		1	2d Steamer.	2d Steamer.	Ord.	2	Armory.
2		"		1		1st Dinghy.		2	
2		G. M. 2d C.		2		1st Cutter.		3	
2		"		3		1st Cutter.		3	
2		"		3		3d Cutter.		3	Sec. Battery.
2		G. M. 3d C.		4		3d Cutter.		4	
2		"		3	2d Steamer.	2d Steamer.	Ord.	4	5th Div. Battery.
2		"		Pow.		5th Cutter.		4	Dynamo.
2		Chief Elec.		"		5th Cutter.		1	
2		Elec. 2d C.		"		1st Whale.		3	
2		Q. M. 1st C.		Nav.		Balsa.		2	
2		Q. M. 3d C.		"	2d Steamer.	2d Steamer.	Col.	4	
2		Chief C. M.		Pow.	1st Steamer.	1st Steamer.	Pion.	1	
2		C. M. 3d C.		"	2d Steamer.	2d Steamer.	Amb.	4	
2		Shipw't.		"		5th Cutter.		4	
2		P. & F.		"	1st Steamer.	1st Steamer.	Pion.	2	
2		Paint.		"	2d Steamer.	2d Steamer.	Amb.	4	
2		Sea.	Charge Hold.	"		Gig.		4	
2		Lds.	J. of D.	"	1st Steamer.	1st Steamer.	Com.	4	
2		Hosp. Stew.		Surg.	2d Steamer.	2d Steamer.	Amb.	1	
2		Hosp. App.		"	Gig.	Gig.		4	

FORECASTLE.

FIRST PART. PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
					Running.	Arm & Away.	Abandon.			
102		Cox.		1	2d Cutter.	2d Cutter.	2d Cutter.	2	4	
104		Cox.		1	5th Cutter.	5th Cutter.	5th Cutter.	2	4	
112		Sea.		1		1st Cutter.	1st Cutter.	2	6	
114		"		1		1st Cutter.	1st Cutter.	2	6	
116		"		1		1st Cutter.	1st Cutter.	2	6	Windlass.
118		"		1		2d Cutter.	2d Cutter.	2	6	
120		"		1		2d Cutter.	2d Cutter.	2	6	
122		"		1		2d Cutter.	2d Cutter.	2	6	
124		"		1		5th Cutter.	5th Cutter.	2	6	
126		"		1		5th Cutter.	5th Cutter.	2	6	Side Comm.
132		O. S.		1		1st Cutter.	1st Cutter.	2	6	
134		"		1		1st Cutter.	1st Cutter.	2	6	
136		"		1		2d Cutter.	2d Cutter.	2	6	
138		"		1		5th Cutter.	5th Cutter.	2	6	
140		"		1		5th Cutter.	5th Cutter.	2	6	
152		App.		1		1st Cutter.	1st Cutter.	2	6	Turret Ry.
154		"		1		1st Cutter.	1st Cutter.	2	6	
156		"		1		2d Cutter.	2d Cutter.	2	6	
158		"		1		2d Cutter.	2d Cutter.	2	6	
160		"		1		5th Cutter.	5th Cutter.	2	6	
162		"		1		5th Cutter.	5th Cutter.	2	6	
164		"		1		5th Cutter.	5th Cutter.	2	6	
166		"		Nav.		Gig.	Gig.	2	6	
168		"		Pow.		2d Dinghy.	2d Dinghy.	2	6	
172		Lds.		1		1st Cutter.	1st Cutter.	2	6	Mess Cook.
174		"		1		2d Cutter.	2d Cutter.	2	6	
176		"		1		2d Cutter.	2d Cutter.	2	6	
178		"		Pow.		5th Cutter.	5th Cutter.	2	6	Capt. of Hd.

FORECASTLE.

FIRST PART. STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
				Running.	Arm & Away.	Abandon.			
	B.M.2C.		1		1st Cutter.	1st Cutter.	2	3	
	Cox.		1	1st Cutter.	1st Cutter.	1st Cutter.	2	4	
	Sea.		1		1st Cutter.	1st Cutter.	2	5	
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		Nav.		5th Cutter.	5th Cutter.	2	5	
	O.S.		1		1st Cutter.	1st Cutter.	2	5	Side Cleaner.
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	Capt. of Head.
	App.		1		1st Cutter.	1st Cutter.	2	5	
	"		1		1st Cutter.	1st Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		1		5th Cutter.	5th Cutter.	2	5	
	"		Nav.		Gig.	Gig.	2	5	Signalman.
	"		Pow.		1st Dinghy.	1st Dinghy.	2	5	
	Lds.		1		1st Cutter.	1st Cutter.	2	5	Orlop Deck Sweeper.
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		1		2d Cutter.	2d Cutter.	2	5	
	"		Pow.		5th Cutter.	5th Cutter.	2	5	Mess Cook.

FORECASTLE.

SECOND PART. PORT WATCH.

	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
					Running.	Arm & Away.	Abandon.			
202		Cox.		2	2d Launch.	2d Launch.	2d Launch.	4	4	
204		Cox.		2	2d Whale.	2d Whale.	2d Whale.	4	4	
212		Sea.		2		2d Launch.	2d Launch.	4	8	
214		"		2		2d Launch.	2d Launch.	4	8	
216		"		2		2d Launch.	2d Launch.	4	8	
218		"		2		2d Launch.	2d Launch.	4	8	
220		"		2		2d Whale.	2d Whale.	4	8	Bag Room.
222		"		2		2d Whale.	2d Whale.	4	8	
224		"		Nav.		1st Steamer.	1st Steamer.	4	8	
232		O. S.		2		2d Launch.	2d Launch.	4	8	R.D. Sway
234		"		2		2d Launch.	2d Launch.	4	8	
236		"		2		2d Whale.	2d Whale.	4	8	
238		"		2		2d Whale.	2d Whale.	4	8	Mess Cook.
240		"		2		1st Steamer.	1st Steamer.	4	8	
252		App.		2		2d Launch.	2d Launch.	4	8	
254		"		2		2d Launch.	2d Launch.	4	8	
256		"		2		2d Launch.	2d Launch.	4	8	
258		"		2		2d Launch.	2d Launch.	4	8	
260		"		2		2d Whale.	2d Whale.	4	8	
262		"		2		2d Whale.	2d Whale.	4	8	
264		"		2		2d Whale.	2d Whale.	4	8	
266		"		Nav.		Gig.	Gig.	4	8	
272		Lds.		2		2d Launch.	2d Launch.	4	8	
274		"		2		2d Launch.	2d Launch.	4	8	Side Cleaner
276		"		2		2d Whale.	2d Whale.	4	8	
278		"		Pow.		2d Whale.	2d Whale.	4	8	Com. Store-room

FORECASTLE.

SECOND PART. STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
				Running.	Arm & Away.	Abandon.			
	B.M.2 C.		2		2d Launch.	2d Launch.	4	3	
	Cox.		2	1st Steamer.	1st Steamer.	1st Steamer.	4	4	
	Sea.		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		1st Steamer.	1st Steamer.	4	7	Side Cleaner.
	O. S.		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	Mess Cook.
	App.		2		2d Launch.	2d Launch.	4	7	Dyn. Inst.
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	5	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		Nav.		1st Steamer.	1st Steamer.	4	7	Signalman.
	Lds.		2		2d Launch.	2d Launch.	4	7	Mess Cook.
	"		2		2d Launch.	2d Launch.	4	7	
	"		2		2d Whale.	2d Whale.	4	7	
	"		Pow.		1st Steamer.	1st Steamer.	4	7	B.D. Sweep'r.

AFTERGUARD.

FIRST PART. PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
					Running.	Arm & Away.	Abandon.			
302		B. M. 2 C.		3		1st Launch.	1st Launch.		3	
304		Cox.		3	2d Steamer.	2d Steamer.	2d Steamer.	3	4	
312		Sea.		3		1st Launch.	1st Launch.	2	10	
314		"		3		1st Launch.	1st Launch.	2	10	
316		"		3		2d Steamer.	2d Steamer.	3	10	
318		"		3		2d Steamer.	2d Steamer.	3	10	Side Cleaner
320		"		3		1st Whale.	1st Whale.	4	10	
322		"		3		1st Whale.	1st Whale.	4	10	
324		"		3		1st Whale.	1st Whale.	4	10	
332		O. S.		3		1st Launch.	1st Launch.	2	10	
334		"		3		1st Launch.	1st Launch.	2	10	
336		"		3		2d Steamer.	2d Steamer.	3	10	Mess Cook.
338		"		3		1st Whale.	1st Whale.	4	10	
340		"		3		1st Whale.	1st Whale.	4	10	
352		App.		3		1st Launch.	1st Launch.	2	10	
354		"		3		1st Launch.	1st Launch.	2	10	
356		"		3		2d Steamer.	2d Steamer.	3	10	
358		"		3		2d Steamer.	2d Steamer.	3	10	
360		"		3		1st Whale.	1st Whale.	4	10	
362		"		3		1st Whale.	1st Whale.	4	10	
364		"		3		1st Whale.	1st Whale.	4	10	
366		"		Nav.		1st Whale.	1st Whale.	Sig.	10	Signalman
372		Lds.		3		1st Launch.	1st Launch.	2	10	Mess Cook.
374		"		3		2d Steamer.	2d Steamer.	3	10	
376		"		3		2d Steamer.	2d Steamer.	3	10	
378		"		Pow.		1st Whale.	1st Whale.	4	10	B.D. Sweeper

AFTERGUARD.

FIRST PART. STARBOARD WATCH.

Names.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
				Running.	Arm & Away.	Abandon.			
	Cox.		3	1st Launch.	1st Launch.	1st Launch.	2	4	
	Cox.		3	1st Whale.	1st Whale.*	1st Whale.	4	4	
	Sea.		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	3	9	
	"		3		1st Launch.	1st Launch.	3	9	Gen. Store.
	"		3		1st Whale.	1st Whale.	4	9	
	"		Nav.		1st Whale.	1st Whale.	4	9	
	O.S.		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	3	9	
	"		3		1st Launch.	1st Launch.	3	9	Side Cleaner.
	"		3		1st Whale.	1st Whale.	4	9	
	App.		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	3	9	Dyn. Inst.
	"		3		1st Launch.	1st Launch.	3	9	
	"		3		1st Launch.	1st Launch.	3	9	
	"		3		1st Whale.	1st Whale.	4	9	
	"		3		1st Whale.	1st Whale.	4	9	
	"		Nav.			1st Whale.	Sig.	9	Signalman.
	Lds.		3		1st Launch.	1st Launch.	2	9	Bag Room Lamps.
	"		3		1st Launch.	1st Launch.	2	9	
	"		3		1st Launch.	1st Launch.	3	9	
	"		Pow.		1st Whale.	1st Whale.	4	9	Mess Cook.

AFTERGUARD.

SECOND PART. PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Duty.
					Running.	Arm & Away.	Abandon.			
402		B. M. 2 C.		4		3d Cutter.	3d Cutter.	3	3	
404		Cox.		4	3d Cutter.	3d Cutter.	3d Cutter.	3	4	
412		Sea.		4		3d Cutter.	3d Cutter.	3	12	
414		"		4		3d Cutter.	3d Cutter.	3	12	
416		"		4		3d Cutter.	3d Cutter.	3	12	
418		"		4		3d Cutter.	3d Cutter.	3	12	
420		"		4		4th Cutter.	4th Cutter.	3	12	
422		"		4		4th Cutter.	4th Cutter.	3	12	
424		"		4		4th Cutter.	4th Cutter.	3	12	
426		"		Nav.		4th Cutter.	4th Cutter.	3	12	
432		O. S.		4		3d Cutter.	3d Cutter.	3	12	Side Cleaner.
434		"		4		3d Cutter.	3d Cutter.	3	12	R. D. Sweeper.
436		"		4		4th Cutter.	4th Cutter.	3	12	
438		"		4		4th Cutter.	4th Cutter.	3	12	Mess Cook.
440		"		4		4th Cutter.	4th Cutter.	3	12	
452		App.		4		1st Dinghy.	1st Dinghy.	3	12	
454		"		4		1st Dinghy.	1st Dinghy.	3	12	
456		"		4		2d Dinghy.	2d Dinghy.	3	12	
458		"		4		2d Dinghy.	2d Dinghy.	3	12	
460		"		4		3d Cutter.	3d Cutter.	3	12	
462		"		4		3d Cutter.	3d Cutter.	3	12	
464		"		Nav.		4th Cutter.	4th Cutter.	3	12	Signalman.
466		"		Pow.		Gig.	Gig.	3	12	
472		Lds.		4		3d Cutter.	3d Cutter.	3	12	Mess Cook.
474		"		4		3d Cutter.	3d Cutter.	3	12	
476		"		4		4th Cutter.	4th Cutter.	3	12	Orlop Sweeper.
478		"		Pow.		4th Cutter.	4th Cutter.	3	12	

AFTERGUARD.

SECOND PART. STARBOARD WATCH.

No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.			Co.	Mess.	Special Detail.
					Running.	Arm & Away.	Abandon.			
		Cox.		4	4th Cutter.	4th Cutter.	4th Cutter.	3	4	
		Cox.		4	Gig.	Gig.	Gig.	3	4	
		Sea.		4		3d Cutter.	3d Cutter.	3	11	
		"		4		3d Cutter.	3d Cutter.	3	11	
		"		4		3d Cutter.	3d Cutter.	3	11	Side Cleaner.
		"		4		3d Cutter.	3d Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	
		O. S.		4		3d Cutter.	3d Cutter.	3	11	
		"		4		3d Cutter.	3d Cutter.	3	11	Mess Cook.
		"		4		4th Cutter.	4th Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	
		App.		4		1st Dinghy.	1st Dinghy.	3	11	Turret Boy.
		"		4		1st Dinghy.	1st Dinghy.	3	11	
		"		4		2d Dinghy.	2d Dinghy.	3	11	
		"		4		2d Dinghy.	2d Dinghy.	3	11	
		"		4		3d Cutter.	3d Cutter.	3	11	
		"		4		3d Cutter.	3d Cutter.	3	11	
		"		4		3d Cutter.	3d Cutter.	3	11	
		"		Nav.			3d Cutter.	3	11	Signalman.
		"		Pow.		Gig.	Gig.	3	11	
		Lds.		4		3d Cutter.	3d Cutter.	3	11	Orlop Sweeper.
		"		4		3d Cutter.	3d Cutter.	3	11	
		"		4		4th Cutter.	4th Cutter.	3	11	Mess Cook.
		"		Pow.		4th Cutter.	4th Cutter.	3	11	

MARINES.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
502		Serg.		5	2d Launch.	2d Launch.	1	14	
504		"		5		2d Launch.	1	14	
506		Corp.		5	2d Cutter.	2d Cutter.	1	14	
508		"		5		2d Launch.	1	14	
510		Music.	Fifer.	5	2d Launch.	2d Launch.	1	14	
512		Priv.		5	2d Launch.	2d Launch.	1	14	
514		"		5	2d Launch.	2d Launch.	1	14	
516		"		5	2d Launch.	2d Launch.	1	14	
518		"		5	2d Launch.	2d Launch.	1	14	
520		"		5	2d Launch.	2d Launch.	1	14	
522		"		5	2d Launch.	2d Launch.	1	14	
524		"		5	2d Launch.	2d Launch.	1	14	B. D. Sweeper.
526		"		5		2d Launch.	1	14	
528		"		5		2d Launch.	1	14	
530		"		5		2d Launch.	1	14	
532		"		5		2d Launch.	1	14	
534		"		5		2d Launch.	1	14	
536		"		5		2d Launch.	1	14	
538		"		5		2d Launch.	1	14	
540		"		5		2d Launch.	1	14	
542		"		Pow.	2d Launch.	2d Launch.	1	14	
544		"		"	2d Launch.	2d Launch.	1	14	Mess Cook.
546		"		"	2d Launch.	2d Launch.	1	14	
548		"		"	2d Launch.	2d Launch.	1	14	
550		"		"	2d Launch.	2d Launch.	1	14	
552		"		"		2d Launch.	1	14	
554		"		"		2d Launch.	1	14	
556		"		"	2d Cutter.	2d Cutter.	1	14	
558		"		"	2d Cutter.	2d Cutter.	1	14	
560		"		"	2d Cutter.	2d Cutter.	1	14	

MARINES.

STARBOARD WATCH.

V. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
		1st Serg.		5	1st Launch.	1st Launch.	1	1	
		Serg.		5	1st Cutter.	1st Cutter.	1	13	
		Corp.		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	Police.
		Music.	Drum.	5		1st Launch.	1	13	
		Priv.		5	1st Launch.	1st Launch.	1	13	
		"		5	1st Launch.	1st Launch.	1	13	
		"		5	1st Launch.	1st Launch.	1	13	
		"		5	1st Launch.	1st Launch.	1	13	
		"		5	1st Launch.	1st Launch.	1	13	
		"		5	1st Launch.	1st Launch.	1	13	
		"		5	1st Launch.	1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		1st Launch.	1	13	
		"		5		Gig.	1	13	Orderly.
		"		Pow.	1st Launch.	1st Launch.	1	13	
		"		"	1st Launch.	1st Launch.	1	13	
		"		"	1st Launch.	1st Launch.	1	13	
		"		"	1st Launch.	1st Launch.	1	13	
		"		"	1st Launch.	1st Launch.	1	13	Mess Cook.
		"		"	1st Launch.	1st Launch.	1	13	
		"		"		1st Launch.	1	13	
		"		"	1st Cutter.	1st Cutter.	1	13	
		"		"	1st Cutter.	1st Cutter.	1	13	
		"		"	1st Cutter.	1st Cutter.	1	13	Mess Cook.

ENGINEER PETTY OFFICERS.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
602		Chief Mach.		Eng.		2d Steamer.		1	
604		"		Pow.		Gig.		1	
612		Mach. 1st C.		Eng.		2d Cutter.		15	
614		"		"	2d Steamer.	2d Steamer.	Ord.	15	
616		B'ksmith.		Pow.		2d Launch.		15	
620		W. T.		Eng.		2d Steamer.		15	
622		"				2d Steamer.		15	
624		"		"		2d Cutter.		15	
632		Mach. 2d C.		Eng.	1st Steamer.	1st Steamer.	Pion.	15	
634		"		"		4th Cutter.		15	
636		Oiler.		"		2d Launch.		15	
638		"		"		2d Launch.		15	
640		"		"		4th Cutter.		15	
642		"		Pow.		2d Steamer.		15	

ENGINEER PETTY OFFICERS.

STARBOARD WATCH.

No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
		Chief Mach.		Eng.		1st Steamer.		1	
		"		"		1st Launch.		1	
		Chief Yeo.		"		1st Steamer.		1	
		Mach. 1st C.		Eng.		1st Cutter.		15	
		"		Pow.		1st Steamer.		15	
		Copper-smith.		Eng.		1st Steamer.		15	
		Boiler-maker.		"		1st Steamer.		15	
		W. T.		"		1st Steamer.		15	
		"		"		1st Steamer.		15	
		"		"		1st Cutter.		15	
		Mach. 2d C.		Pow.	2d Steamer.	2d Steamer.	Ord.	15	
		"		Eng.		3d Cutter.		15	
		Oiler.		"		1st Cutter.		15	
		"		"		3d Cutter.		15	
		"		"		5th Cutter.		15	
		"		Pow.		1st Steamer.		15	

FIREMEN.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Duty.
					Arm & Away.	Abandon.			
702		Fire 1st C.		Eng.		2d Steamer.			
704		"		"		2d Steamer.			
706		"		"		2d Steamer.		16	
708		"		"		2d Launch.		17	
710		"		"		2d Launch.		18	
712		"		"		Balsa.			
714		"		"		2d Dinghy.			
752		Fire 2d C.		Eng.		2d Steamer.			
754		"		"		2d Steamer.			
756		"		"		2d Launch.		16	
758		"		"		2d Launch.		17	
760		"		"		2d Launch.		18	
762		"		"		Balsa.			
764		"		"		2d Dinghy.			

FIREMEN.

STARBOARD WATCH.

No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
		Fire 1st C.		Eng.		1st Steamer.			
		"		"		1st Steamer.			
		"		"		1st Steamer.		16	
		"		"		1st Launch.		17	
		"		"		1st Launch.		18	
		"		"		1st Launch.			
		"		"		1st Dinghy.			
		Fire 2d C.		Eng.		1st Steamer.			
		"		"		1st Steamer.			
		"		"		1st Steamer.		16	
		"		"		1st Launch.		17	
		"		"		1st Launch.		18	
		"		"		1st Launch.			
		"		"		1st Dinghy.			

COAL PASSERS.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Duty.
					Arm & Away.	Abandon.			
802		C. P.		Eng.		1st Steamer.			
804		"		"		2d Steamer.			
806		"		"		2d Launch.			
808		"		"		2d Launch.			
810		"		"		2d Cutter.			
812		"		"		2d Cutter.			
814		"		"		4th Cutter.			
816		"		"		4th Cutter.			
818		"		Pow.		2d Whale.			
820		"		"		2d Whale.		16	
822		"		"		2d Dinghy.		17	Bag Boom.
824		"		"		2d Dinghy.		18	
826		"		"		Balsa.			
828		"		"		Balsa.			
830		"		"		Balsa.			Mess Cook.
832		"		"		2d Punt.			
834		"		"		2d Punt.			
836		"		"		2d Punt.			
838		"		"	1st Steamer.	1st Steamer.	Pion.		Mess Cook.
840		"		"	1st Steamer.	1st Steamer.	Pion.		

COAL PASSERS.

STARBOARD WATCH.

No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
					Arm & Away.	Abandon.			
		C. P.		Eng.		1st Steamer.			
		"		"		1st Steamer.			
		"		"		1st Launch.			
		"		"		1st Launch.			
		"		"		1st Cutter.			
		"		"		1st Cutter.			
		"		"		3d Cutter.			
		"		"		3d Cutter.			
		"		Pow.		5th Cutter.			
		"		"		5th Cutter.		16	
		"		"		5th Cutter.		17	
		"		"		1st Whale.		18	
		"		"		1st Whale.			Mess Cook.
		"		"		1st Dinghy.			
		"		"		1st Dinghy.			
		"		"		Balsa.			
		"		"		1st Punt.			
		"		"		1st Punt.			
		"		"		1st Punt.			
		"		"	1st Steamer.	1st Steamer.	Pion.		Mess Cook.
		"		"	1st Steamer.	1st Steamer.	Pion.		

MESSMEN.

PORT WATCH.

W. No.	Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Duty.
					Arm & Away.	Abandon.			
912		Cab. C.		Pow.		Gig.		Cab.	
922		W. R. C.		Pow.		2d Steamer.		W. R.	
924		M. A.		Pow.		2d Launch.		W. R.	
926		"		Pow.		2d Cutter.		W. R.	
928		"		Pow.		4th Cutter.		W. R.	
930		"		Pow.		2d Steamer.		W. R.	
942		J. O. C.		Pow.		2d Whale.		J. O.	
944		M. A.		Pow.		2d Cutter.		J. O.	
952		W. O. C.		Pow.		2d Launch.		W. O.	
962		S. C. 2d C.		Pow.		2d Launch.			Rdr.
964		"		Pow.	2d Steamer.	2d Steamer.			
966		S. C. 3d C.		Pow.		1st Steamer.	Com		
968		S. C. 4th C.		Pow.		2d Cutter.			

MESSMEN.

STARBOARD WATCH.

Name.	Rate Allowed.	Actual Rate.	Div.	BOAT.		Co.	Mess.	Special Detail.
				Arm & Away.	Abandon.			
	Cab. S.		Pow.		Gig.		Cab.	
	M. A.		Pow.		Gig.		Cab.	
	W. R. S.		Pow.		1st Steamer.		W. R.	
	M. A.		Pow.		1st Launch.		W. R.	
	"		Pow.		1st Cutter.		W. R.	
	"		Pow.		3d Cutter.		W. R.	
	"		Pow.		5th Cutter.		W. R.	
	J. O. S.		Pow.		1st Whale.		J. O.	
	M. A.		Pow.		1st Cutter.		J. O.	
	"		Pow.		3rd Cutter.		J. O.	
	W. O. S.		Pow.		1st Launch.		W. O.	
	M. A.		Pow.		1st Whale.		W. O.	
	S. C. 1st C.		Pow.		1st Launch.			
	S. C. 2d C.		Pow.	1st Steamer.	1st Steamer.	Com		
	S. C. 3d C.		Pow.		1st Steamer.			
	S. C. 4th C.		Pow.		1st Cutter.			
	"		Pow.		3d Cutter.			Baker.

Collision Bill (Summary).

The signal is three or more shrieks of the siren, and the mechanical alarm gongs; then one long blast of the bugle indicates injury forward; three long blasts, injury aft.

The closing of all water-tight doors and hatches outside of the engine and boiler rooms and their dependencies, is done by the powder division; also automatic and other valves in the main air-duct. Every man in the division is stationed by watch number at some one door, hatch, valve or pump. The work of closing hatches will begin at the lowest compartment of each group, and the work of closing doors and air-ports will begin at the extreme ends of the ship forward and aft, the various parties uniting and working together as each group is completed. Each party will keep in mind to make sure that no one is shut in below. The parties working aft from forward and forward from aft, will finally form on the berth deck in B 106, ready to open such compartments as may be designated. The last hatch closed from below the berth deck will be the armored hatch from the ammunition passage B 63 to B 106. The two hatches to the main deck from C 101 will not be closed until the powder division and engineer's division shall all be reported up in obedience to orders to that effect.

The closing of all W. T. doors and hatches in the engine and boiler rooms and their dependencies will be done by the engineer's division; and the engineer on watch will have the available steam pumps connected with the flooded compartment or with the compartment into which the flooded one drains.

The collision mat is handled by the 1st division if the injury is forward, and by the 4th division if the injury is aft. In either case the port watch of the division will carry the mat to the point indicated and leave it there and form on the opposite side of the deck ready to man the hogging line or render such assistance as may be required; the starboard watch will provide and prepare the guys, hogging line and distance line, take charge of the mat and get it overboard.* The chief boatswain's mate, with six men specially and permanently detailed, will in all cases get the hogging line over the bow and aft to the point of injury.

* The mat is kept on top the hammock netting on the port side forward, and the guys, etc., on the starboard side.

The men to shackle and attend the forward and after guys, hogging line, halliard and distance line, will be individually stationed by the officers commanding the 1st and 4th divisions, who will be responsible for a proper detail and proper knowledge of the fact by the men so detailed.

In every compartment of the ship, at least one beam has the frame number stenciled upon it; and on deck the position of every fifth frame is indicated by its number stenciled on the side of the waterways. Also, the position of every under-water sea connection is indicated in the waterways as follows: the name of the opening is stenciled on the outboard vertical side; upside down, on the inboard side, is stenciled the depth of the opening in feet below the rail, measured along the shape of the hull, so that with the corresponding mark of the distance line at the rail, the center of the mat will be at the opening.

The 2nd and 3rd divisions fall in, ready to lend a hand at the guys or where required.

If at battle stations, the siren will not be sounded; the signal for closing W. T. doors and hatches will be the springing of boarders' rattles in ammunition passages, 13-inch handling rooms and central passage of fire-rooms. As all hatches and doors outside of those parts of the ship are closed before going into action, the powder division will not have occasion to leave the ammunition passages. The only doors to be closed in those passages themselves will be the two after ones and the port forward one, so that the central station can still be occupied, and a certain amount of the ammunition supply maintained until the order is received to abandon the orlop deck, when everything will be closed and the division will form on the berth deck. The 13-inch handling room crews will close their magazine and shell-room doors, and the hatches leading to the turning engine-rooms; if called up, their escape will be through the top of the turret.

Fire Bill (Summary).

Fire forward is indicated by one stroke of the bell and one bugle blast, following the alarm; fire aft, by three strokes and three blasts. The stationing is by divisions; the powder and engineer's divisions, each in their own part, handling all lines of hose below the main deck, and the gun divisions the hose in their parts of the ship.

If the fire occurs when not under steam, the various lines of hose will be connected and led out in the same manner and by the same men as when the steam-pumps are available; the valves isolating the hand-pumps will be opened, and the combined force of all these pumps will be delivered into the fire main so as to be available in any part of the ship.

All the men of the powder division are specially stationed by watch numbers at the various doors, hatches, air-ports, air-duct valves, hoses and connections; and in closing whatever hatches must be closed, they are to be careful to search for and give warning to men in distant compartments. When there is no steam on the ship this division mans the starboard berth deck hand-pump. In the gun divisions, certain men are stationed by their watch numbers at each line of hose, and at each valve and nozzle; four men from each seaman division are detailed as smotherers and two as axemen; and others to be ready to cover hatches if ordered. Men not specially stationed fall in at their quarters and stand by to man the hand-pumps, assisted by hatch-coverers and hose-men as relief crews, each division having one hand-pump assigned to it. No line of hose will be led below the main deck without special orders.

The gunner and his mates will stand by to flood the threatened magazines and shell-rooms.

If in action, or at battle stations, the division officer nearest to the fire will detail men to attack it. No alarm will be sounded, and the fire will not be reported to the conning tower unless it threatens to assume serious proportions, or materially weakens the gun-fire of any division or the general supply of ammunition. If reported, the fact of its being gotten well under control must also be immediately reported. The officer of the powder division will immediately close any magazine or shell-room that may be threatened, and be prepared to flood them; if within the limits of his action, he will attack the fire with grenades and hose, and endeavor to isolate it by closing doors and hatches, and he will continue to serve the battery from the magazines and shell-rooms that are not threatened.

Boat Bill (Summary).

The running boats' crews are so made up of available men that when any boat is called away it will affect all parts of the ship

about equally. Men on special details, such as side cleaners, mess cooks, messengers, etc., are not in running boats. Enough men are stationed in each running crew to allow for two or three vacancies; if a crew should still be short when called away, vacancies will be filled as follows:

1st Steamer	is supplied	from	1st Cutter.
1st Whaleboat	"	"	1st Cutter.
1st Cutter	"	"	1st Launch.
2nd Steamer	"	"	2nd Cutter.
2nd Whaleboat	"	"	2nd Cutter.
2nd Cutter	"	"	2nd Launch.
3rd Cutter	"	"	4th Cutter.
4th Cutter	"	"	3rd Cutter.
5th Cutter	"	"	1st Cutter.

All officers and men stationed in boats at "Arm and Away" are in the same boats at "Abandon Ship," except the apothecary and a bayman, who are in the gig (hospital boat) at "Arm and Away," but in other boats at "Abandon." *

At "Arm and Away," the 1st division mans the 1st, 2nd, and 5th cutters, which hang forward in port; the 2nd division, the 2nd launch and 2nd whaleboat; the 3rd division, the 1st steamer, 1st launch and 1st whaleboat; the 4th division, the 2nd steamer, and 3rd and 4th cutters. Each division entire, and the men of the navigator's and powder divisions who are in that same part of the ship, are detailed for the boats; but the number to be carried for "Cutting Out" is prescribed for each boat, and its officer will take only that number. If called away for "Distant Service" the boat officers will take only the pulling crews. The marines embark for "Cutting Out" in the two launches and 1st and 2nd cutters. The steamers each carry a boat-gun with its crew, and no other men except for landing the battalion, on which occasion they carry the color guard, signalmen, and pioneer, commissary, ambulance and ordnance parties.

The expedition is commanded by the executive officer. The boatswain is beachmaster.

* These two exceptions, while found convenient, are not a necessity, and in making out a new bill I would do away with them, as in the bill suggested. A surgeon and one hospital apprentice are plenty for a boat expedition; and if the whole battalion were landed for active service, the ambulance party would go.

At "Abandon Ship," all the rest of the ship's company is divided among the boats so as to bring up the number in each as follows in the table below, together with the amount of provisions in each. The quantities of provisions are based approximately upon the rate of 3 pints of water, 1 lb. of bread, and 10 ozs. of meat per man per day for four days.

Boat.	Number of men.	Number and capacity of breakers.	Tins of bread.	24-lb. boxes of meat.
1st Steamer.	40	3 of 20 gals.	6	4
2nd Steamer.	40	3 of 20 gals.	6	4
1st Launch.	68	5 of 20 gals.	10	7
2nd Launch.	68	5 of 20 gals.	10	7
1st Cutter.	33	2 of 20; 1 of 10	5	3
2nd Cutter.	33	2 of 20; 1 of 10	5	3
3rd Cutter.	33	2 of 20; 1 of 10	5	3
4th Cutter.	27	2 of 20 gals.	4	3
5th Cutter.	24	2 of 20 gals.	4	3
1st Whaleboat.	23	2 of 20 gals.	4	3
2nd Whaleboat.	23	2 of 20 gals.	4	3
Gig.	16	1 of 20 gals.	2	2
1st Dinghy.	10	2 of 10 gals.	2	1
2nd Dinghy.	10	2 of 10 gals.	2	1
1st Punt.	4	1 of 10 gals.	1	1
2nd Punt.	4	1 of 10 gals.	1	1
Balsa.	7	1 of 10 gals.	1	1
	463			

The 1st Dinghy keeps company with 1st Launch.
" 2nd Dinghy " " " 2nd Launch.
" Balsa " " " 1st Steamer.
" 1st Punt " " " 1st Cutter.
" 2nd Punt " " " 2nd Cutter.

For Landing Force, the battalion, of four companies, is conveyed to the shore as follows:

1st Company (marines) in 1st Launch.
2nd " in 2nd Launch.
3rd " in 1st and 3rd Cutters.
4th " in 2nd and 4th Cutters.

Commissary and Pioneer parties and Signalmen in 1st Steamer.
Color Guard, Ambulance and Ordnance parties in 2nd Steamer.
The 1st Steamer takes the starboard tow—odd-numbered boats.
" 2nd " " port " —even- " "

Clear Ship for Action Bill (Summary).

If awnings are spread or up, each part of the ship will furl its awnings and send them below, and the men will then join their divisions.

All other work will be performed by the divisions under the supervision of the division officers, each in the part of the ship where it is located. The powder division has jurisdiction in assigning stowage for articles struck below. Nothing shall be so stowed as to interfere with free movement about the decks, or out to the side below where it could interfere with reaching shot-holes.

The master-at-arms and main-deck mess cooks will assist the 5th division in clearing away and securing mess chests, etc., before joining their own divisions.

Storekeepers will close their W. T. doors and hatches as soon as required articles have been received or issued; and they will report the fact to the carpenter.

When clearing ship for exercise, the following variations will be observed: Exercise heads will be attached to torpedoes, and the gear set for coming to the surface; ready magazines will not be filled; all binnacles will be left in place; fires will not be lighted in boilers not in use, nor spread where banked; coal will not be trimmed down into lower bunkers; ashes will not be hoisted; steam will not be turned on main engines if not already on; flushing pumps will not be stopped.

[All the work to be done as directed in the department's Instructions is stated in detail for each division, without assigning any particular duty to any particular watch number.]

Casualty Bill (Summary).

When R. F. guns' crews are depleted in action, the crews of the corresponding guns on the unengaged side will fill the vacancies.

When one of the forward 8-inch turret crews is depleted, the crews of 6-pdr. No. 9 (on bridge deck) will fill vacancies, beginning with the one on the unengaged side; the after 8-inch turrets draw similarly from No. 17.

If the motor of a 6-pdr. ammunition hoist becomes disabled, the hand-power gear will be worked by the powder division assisted by two men on either side from the secondary battery. If

the hoist breaks down, the powder division will pass the ammunition up to the berth deck through the hatch on the starboard side, and the secondary battery crews will rig and man a tackle down the hatches from the upper-deck beam.

If the 8-inch ammunition hoists become disabled, the turret crews will man the tackle.

If the 8-inch steam training gear becomes disabled, the hand gear on the orlop deck will be manned by men from the turret crews, reinforced, when necessary, by the powder division.

If the 13-inch steam training gear becomes disabled, the hand gear will be manned by the handling room crews, reinforced by men from the engine and fire rooms respectively, until further arrangements are made from the conning tower.

Six-pounder crews Nos. 9 and 17 (bridge deck) form auxiliary search-light crews.

Torpedo Defense Bill (Summary).

The 8-inch, 6-pdr., and 1-pdr. crews will be at their guns.

The 1st and 4th divisions, except the R. F. and machine guns' crews, will man the rail on the forecastle and quarter deck respectively, with rifles.

The riflemen of the 5th division will man the rail between the casemate and the 1st and 4th divisions, No. 7 guns' crew forward, No. 8 aft.

The navigator's division will man the search-lights and field guns.

The powder and engineer's divisions will close all water-tight doors and hatches.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SKETCHES FROM THE SPANISH-AMERICAN WAR.

By COMMANDER J——.

[Translated from the Marine-Rundschau, January and February, 1899—Concluded.]

[Reprinted from records of Office of Naval Intelligence by permission of Chief Intelligence Officer.]

INTRODUCTORY.

Sketches from the naval battle of Santiago and occupation of Puerto Rico, by Commander Jacobsen, of the German protected cruiser Geier, given in this number of the War Notes, are a continuation of Sketches from the Spanish-American War, by the same officer, given in War Notes No. III.

RICHARDSON CLOVER,
Commander, U. S. N., Chief Intelligence Officer.

NAVY DEPARTMENT, *March 27, 1899.*

Approved:
A. S. CROWNINSHIELD, *Rear-Admiral, U. S. N.,*
Chief of Bureau of Navigation.

VI. THE NAVAL BATTLE OF SANTIAGO.

1. I have no official sources at my disposal from which to give an account of the battle. The reports of Admiral Sampson and the commanders of the American ships, as well as the reports on the condition of the Spanish vessels after the battle and on the positions and movements of all ships during the battle, were published in the New York Herald. From the Spanish side nothing

has been published except a short report of Admiral Cervera to Captain-General Blanco and an article entitled "Admiral Cervera's fleet," published in the Revista General de Marina. Under these circumstances it is inevitable that errors and omissions will occur in the account of the battle; but, on the whole, it will probably give an approximately correct idea.

Paragraphs 2-13, inclusive, have not been translated, as they were from the United States publications containing:

(1) Descriptions of the United States and Spanish vessels engaged in the battle.

(2) Chart showing the positions of the ships during the battle at different times between 9.30 a. m. and 1.15 p. m. from the records of the United States Naval Board appointed to plot such positions.

(3) Description of the engagement compiled from official reports of the commanders of the United States vessels.

(4) Condition of Spanish vessels after the battle, as shown by the United States board appointed to examine them.

14. With Admiral Sampson's permission the officers of the Geier inspected the Spanish ships on August 12, more than a month after the battle, at which time the following observations were made:

(*a*) The ships, after coming out of the harbor entrance on a westerly course, turned to starboard and ran ashore in small coves, where they probably saw the best chance for their crews to reach the shore through the surf.

(*b*) The reason for beaching the ships can probably be found in the fact that the fires which broke out on board after the first American hits could not be controlled by the crews, who had lost their heads under the hail of hostile projectiles. All three of the ships present pictures of the most frightful ruin, chiefly due to the explosions and the conflagrations, which did not reach their full intensity until after the ships had been run ashore. All the woodwork and combustible material had been burned. The following will give an idea of the intense heat that must have prevailed:

The iron deck beams and other horizontal iron parts were very much warped; the bearings of the connecting rods had been melted; the iron masts had been partly melted where they pass through the upper deck; the brass frames of the ports between decks had

been partly melted, and the ports themselves were found on deck converted into large lumps of glass; parts of the rapid-fire mounts had been melted, the lead in the small caliber and machine-gun projectiles had melted and run out, and the casings had been reduced to ashes.

(*c*) Besides the conflagrations and subsequent explosions, the ships sustained such severe leaks when running ashore that it will be impossible to float them again, with the exception of the Maria Teresa, which is now being attempted to be hauled off.*

All the masts of the ships had fallen aft and had been hurled to the deck with their tops. Only the mainmast of the Maria Teresa was left standing, which is an evidence that she ran ashore at less speed, which is further shown by the fact that she sustained less leaks than the other ships. The mainmast of the Oquendo had fallen to starboard and broken in two upon striking the railing and one part gone overboard.

(*d*) Nothing definite could be ascertained as to the boats that had been on board. There was nothing left but the wrecks of two iron steam launches hanging in the warped and partly broken davits on board of each of the ships.

(*e*) The engines were probably intact in all of the ships at the time they ran ashore, for they were apparently running at great speed—at least the Oquendo and the Vizcaya.

The machinery installation on board the ships was about as follows:

a. The two main engines and six main boilers are located in five water-tight compartments below the protective deck. Above them, between decks, and protected by lateral coal bunkers, are two large auxiliary boilers of at least 12 tons capacity, and many auxiliary engines, conspicuous among which is a large and powerful centrifugal bilge pump with a discharge pipe of about 300 mm. diameter. The protective deck, extending from the stem to the after torpedo room, is slightly vaulted forward of the boiler rooms, and pierced above the boiler and engine rooms for the passage of smokestack casings and engine skylight, but is protected at this place by a strong glacis, rising at an angle of about 30 degrees from the inner bunker walls. The openings in the engine skylight and smokestack casings were protected by iron

*In the meantime the Maria Teresa has been floated by American wreckers, but she sank on her way to Norfolk.—Ed. Rundschau.

gratings. The protection by lateral coal bunkers extended through boiler and engine rooms, reaching to the battery deck, a height of 3.5 meters. Alongside the engine rooms in each of the bunkers to port and starboard forward and starboard aft was a room for engine supplies, while to port aft was a well-equipped workshop, extending nearly to the ship's side. In the workshop was a small 1-cylinder steam engine for driving transmission gear, actuating a turning-lathe, a boring engine, a grindstone, and very strong shears, also five vises. The supply rooms appear to have been well equipped, but everything seems to have been stored in wooden closets and on wooden shelves, for all the tools were found scattered on the floor in wild confusion.

β. There was a surprising number of rough castings, especially of stuffing boxes. Spare parts for the main engines were found suspended in the engine skylight; covers, pistons, and slide-valve faces for low-pressure cylinders on the bulkheads. To the smokestack casings were secured three connecting rods, eccentric rods, etc.

γ. Nothing could be noticed of any provisions having been made for the protection of the machinery installations except the iron gratings. In the Almirante Oquendo coal sacks were found near the auxiliary boiler, but their object could not be determined, the boiler room being flooded. The steam pipes above the protective deck do not appear to have been disconnected before the battle. Valves leading to auxiliary engines, which were not used during the fight (such as ash-hoisting machinery, pumps for auxiliary boilers, etc.), were found open. The centrifugal bilge pump above mentioned also appeared to have been in gear. The bulkhead doors above the protective deck were all open. They could not have been opened subsequently, since all the bulkheads had been warped by the heat, but the bolts were intact.

(*f*) At the time of our inspection nothing could be ascertained regarding the injuries in the engine rooms, because they were all under water almost up to the protective deck. It was learned from an American engineer engaged in the wrecking operations of the Infanta Maria Teresa that no dead bodies had been found in the engine and boiler rooms, and hence it is probable that there have been no material injuries to the boilers and steam pipes. All the bunker bulkheads and connecting doors are said to have been open and all the fires of the boilers lighted.

(*g*) The damages above the protective deck had been caused chiefly by the conflagrations, but also by hits from the enemy's secondary battery. The inadequacy of the lateral protection of the engine rooms was striking. The supply rooms and workshops had been hit a number of times. Shots which entered the coal did not go through. Only one hit was noticed in the auxiliary piping above the protective deck of the Infanta Maria Teresa. The shot had gone clear through the pipe without ripping it open, from which it may be inferred that there was no steam in it at the time.

(*h*) On the gun and upper decks the smokestack casings had been perforated in several places, also the smokestacks themselves. Apparently no measures had been taken for closing up these shot holes. The electric wiring had been struck in many places. Shot holes were also noticeable in the speaking tubes. It was not possible, owing to the complete destruction by fire, to make any further investigation of the means of communication and command.

(*i*) The three ships inspected had all their guns on board. The only ones that could not be found were the two 7-centimeter rapid-fire boat guns, but pivots had been provided on both sides of the stern, where these two guns were apparently intended to be installed for use against torpedo-boat attacks at night.

(*k*) From the slight losses which the American ships claim to have sustained, it may be judged that the training of the Spanish gun crews must have been very inadequate. This is not surprising, in view of the statement of one of the Spanish naval officers to the effect that no target practice is held in Spain in time of peace. Other circumstances also give evidence of very inefficient handling of the guns. The turrets and their guns, with the exception of the forward turret of the Almirante Oquendo, were found entirely intact. The loading apparatus for the 28-centimeter guns (Whitworth, Manchester, 1895) was of the hydraulic order, and the loading time was about two minutes. The 14-centimeter rapid-fire guns also were probably not used to their best advantage, owing to want of experience. There was evidently no lack of ammunition, for near some of the guns a number of cartridges were found, and some of the guns were still loaded, but had not been fired. To what circumstance it is due that the breech-blocks of two of the guns were found lying in the

rear of the guns with their pivot bolts torn off, could not be explained. Perhaps this may also be attributed to inefficient handling of the projectiles.

(*l*) Only the port side of the ships was fired upon. The starboard side shows but a few holes, where shots have passed out. Where the course of projectiles could be traced, it was usually ranging from port aft to starboard forward. The destructive effect of the American projectiles is mainly due to the conflagrations caused by them. Aside from a shot through one of the turret roofs, no hits were observed in any of the armored turrets. Neither have any projectiles pierced the side armor, which shows no injuries. Only indentations are noticeable in places where projectiles have struck the armor. Projectiles of 15 centimeters and larger calibers that had hit the ship had in many instances gone out through the other side, making holes about 1 meter square, but without bursting. As the same observation has been made in the bombardments of Santiago and San Juan, it may be assumed that it is due to the uncertain functioning of the base fuse. It is not probable that the Americans used armor-piercing shell, as fragments of projectiles of different sizes found in the vicinity show that explosive shell and not nonexplosive shell were used. Projectiles which had hit smokestacks and masts had gone clear through, making only small, round or oblong shot holes. Hits of small-caliber projectiles (5.7-centimeter) could be noticed in large numbers, and this was corroborated by the statement of an American officer to the effect that they were used in great quantities.

(*m*) The question whether the Spanish had any intention of making use of the torpedo weapon may probably be answered in the negative. The torpedo armaments of the ships, although including a large number of tubes, were so defective that there could hardly be any chance of success as against the powerful American ships. The armaments consisted of two bow, four broadside, and two stern tubes, all above water and of antiquated design, with large cartridges, band-brakes, etc., all located above the armored deck and entirely unprotected. In a very primitive manner the tubes had been partly protected by grate bars lashed with chains.

(*n*) The projectiles were 35-centimeter Schwartzkopff torpedoes with large depth-regulating apparatus.

No war-heads were to be found, with a single exception. According to the statement of an American petty officer, the war-heads had been left at Santiago, where they were to be used in connection with the mine obstructions. It is true that this does not agree with the fact that a torpedo head exploded on board the Almirante Oquendo. It is possible, however, that the ships retained one or two war-heads to be used in case of necessity as against rams, since the broadside tubes were adapted to be turned in any direction, or perhaps it was the commander's wish to take a war-head along.

(*o*) The following points support the assumption that it was not the intention to make use of the torpedo weapon:

α. Not one of the tubes still in existence was loaded, and all the tubes were closed. In the tubes destroyed by shots or otherwise no remnants of torpedoes were found.

β. The remaining torpedoes, almost without exception, were lying in their places along the ship's side. No torpedoes were found lying back of the tubes, with the exception of the bow tubes of the Almirante Oquendo.

γ. There was no pressure in any of the flasks. This is shown by the fact that the flasks were entirely uninjured, although the heat had partly melted the tailpieces of the torpedoes.

δ. In several of the torpedoes lying on top, the protecting cap for the depth-regulating apparatus had not been taken off, while it is necessary to remove it in order to put on the war-heads.

ε. In a few of the torpedoes the sinking valves had been put in place, but in most of them they were still found soldered, with connecting links raised.

ζ. The tubes for filling the launching cartridges were not connected and only on the Almirante Oquendo was the powder charge in readiness.

A. Infanta Maria Teresa.

(*p*) This was the flagship, and the first one to be beached, about 6 miles from the entrance of Santiago. The ship's bow was lying only a little higher than usual above the water-line, the stern a little lower; otherwise upright. She evidently ran ashore at slow speed, for aside from the fact that there were only small leakages in the bottom, no boiler explosion took place, nor was the mainmast thrown down. In other respects also her injuries

are much less than those of the other ships. The ammunition rooms appear to have been previously flooded, and therefore did not explode.

(*q*) This ship shows very few hits from the hostile guns, especially few of small caliber as compared with the others. While all the woodwork has been burned, the same as on the other ships, little damage has been sustained by the ship's hull. The ship has therefore been floated by the Americans.* All leaks had been stopped up, the ship pumped out, and then hauled off by steam tugs about 6 feet toward the sea. In this operation she sprang another leak aft and was again filled with water. On the day of our inspection this leak was being stopped up and the water pumped out by means of four steam pumps. Heavy articles, such as anchors, chains, etc., had been transferred to one of the wrecking steamers. While the ship was dry the two forward boilers had been set to work, and with them the auxiliary piping and several bilge pumps. One of the workmen stated that the engines had been found intact. The engine rooms could not be visited, because they were under water up to the tops of the cylinders. It could only be ascertained that the engine skylight had not been damaged.

(*r*) Three hits of large caliber—probably 20-centimeter—were observed:

α. A shell had entered the after torpedo room close above the water-line, had passed through a heavy stanchion and a lateral bulkhead, and out through the starboard side, where it had torn a hole about 1 meter square. There were no indications to show that the projectile had burst. The shot hole on the starboard side was slightly forward of and about 1 meter higher than that on the port side.

β. Another projectile had passed through the whole length of the compartment above this torpedo room and out through the starboard side, likewise without exploding.

γ. A heavy shell must have exploded at the upper conning bridge, for the top of the conning tower, without having been perforated, showed large oblong scars, caused by heavy explosive fragments.

(*s*) A 15-centimeter shell had struck the port bow and loosened

* She sank again on her way to the United States.—Ed. Rundschau.

the re-enforcement ring of the hawse hole. No injuries from explosive fragments were noticed here.

Another 15-centimeter shell had perforated the 3-centimeter shield of a 14-centimeter rapid-fire gun on the port side. Fragments had destroyed the shaft of the elevating gear and both hand wheels. Others had perforated the forward smokestack casing. This hit appears to have annihilated the whole crew of this gun, near which six charred bodies were found.

Another 15-centimeter shell had damaged the after smokestack, after passing through the empty part of a coal bunker, which was still filled with coal to within 1 meter of the ceiling.

(*t*) Very few small-caliber hits were noticed, only 6 in the ship's sides, 2 in the forward, and 5 in the after smokestack, though one of the latter may perhaps have been caused by a 15-centimeter projectile. Near the stern three indentations were noticeable in the side armor, probably caused by 5.7-centimeter projectiles which, striking at a very small angle, had glanced off.

(*u*) Further observations made are as follows:

All the breech-blocks of the rapid-fire guns and parts of the mechanism of the revolving guns had been thrown overboard by the Spaniards. Whether the turret guns had also been rendered unserviceable could not be ascertained. In any event, they had not been injured by hostile projectiles nor by the conflagrations. The gun sights were also missing. Inside the armored turrets no damages of any kind were noticeable. Even the paint had hardly suffered from the heat. In the after-turret gun a projectile had been rammed home, but apparently the cartridge had not been entered. The conning tower was not injured, only burned on the inside.

(*v*) The torpedo-launching tubes and torpedoes had been less damaged by shots and fire than in the other ships. The complete remnants of twenty-four torpedoes were found, with the exception of the war-heads. Only a few practice heads were found.

B. Almirante Oquendo.

(*w*) This ship sustained very severe leaks when running aground. She lies over to port, with the bow about 1 meter light and the stern 1½ meters deep. The ship appeared to have her back broken in the region of the foremast. The rapid-fire ammunition room just forward of the after turret had exploded.

Amidships everything above this room had been hurled down. The protective deck was heaved up and wrenched from the sides. The deck beams throughout were badly warped, and both sides of the ship showed large holes, through which the water was washing in. The second explosion had taken place in the forward rapid-fire ammunition room. The effects were about the same as aft. On one side they were still further increased by the explosion of a torpedo war-head in the forward broadside torpedo room. Here the aperture in the ship's side had reached the dimensions of two meters in width and about 5 meters in length, its lower edge being formed by the armor.

(*x*) The Almirante Oquendo had suffered more than either of the other ships from hostile projectiles.

α. A 15 to 20-centimeter shell had torn a piece about 20 centimeters wide and 50 centimeters long from the upper edge of the gun port in the top of the forward 28-centimeter turret and burst inside. A number of small holes, caused by shell fragments, covering a space of about 1 meter square, were noticeable in the top of the turret. There were no other traces of shell fragments. The bore was empty, the breech-block closed, and a shell was found in the rear of the gun in position for loading. Back of the gun and to the left of it two charred bodies were found, and to the right a mass of human remains that had apparently formed two more bodies. A head was found lying on the platform under the gun. Where the turret commander had been standing another charred body was found lying on its back, with the gun sights under it. The gun itself appeared to have sustained no injuries.

β. A shell, probably of 20-centimeter caliber, had passed through the ship's side in the engine workshop, where it had demolished the transmission shaft, the boring engine, and the turning lathe; then through the engine skylight and exploded on the other side of the latter, in the engine supply room.

γ. A heavy projectile had passed through the smokestack and out through the starboard side without having burst in the ship.

δ. About 25 meters from the stern a heavy shell had struck the 'tween-decks and passed through it. On the starboard side inboard, several small holes were visible, apparently from fragments of this shell.

ε. A shell, probably of 15-centimeter caliber, had hit the shield

of the fourth 14-centimeter rapid-fire gun. The irregular holes noticeable in the forward smokestacks are probably attributable to fragments of this shell. The wheels of the revolving and elevating gear of this gun had also been damaged.

ζ. A 15-centimeter shell had passed through the port coal bunker and out through the starboard bunker.

η. A 14-centimeter rapid-fire gun on the starboard side had been hit on the left side by a 5.7-centimeter shell ranging forward. The projectile with solid point had passed entirely through the forward hoop and penetrated the bore to the depth of 2 centimeters. There were no splinters from the gun, but the displaced metal had been forced out at the edges, which is a proof of its great tenacity. The point of the projectile had been broken off and was lying near the gun. The hole is about 15 centimeters long and at the widest place 5 centimeters wide.

θ. In the whole port side about forty small-caliber hits were counted, most of them amidships. The smokestacks had also been hit several times by small projectiles.

ι. Other observations made on board the Almirante Oquendo are as follows:

The armor had not been injured by any hits. In two of the rapid-fire guns the sights were found set for ranges of 13 and 14 kilometers, and in the 5.7-centimeter after-port gun at 10 kilometers. The sights of all the guns, with the exception of the revolving guns, had traveling eyepieces. None of the sights were found set for short ranges. Some of the 14-centimeter rapid-fire breech-blocks were missing, while some of the guns were found completely loaded.

(y) The torpedo tube in which a torpedo had exploded had been torn into small fragments, the largest of which were a guiding bar and a hinged door. The torpedoes secured to the ship's side had also been destroyed, with the exception of the flasks, which had been hurled several meters from their positions. The bulkhead 'tween-decks near the place of the explosion showed traces of the same. Pieces about 4 centimeters square had passed entirely through it, while still smaller pieces had penetrated it to the depth of several millimeters. The conning tower had remained intact.

In the forward torpedo room torpedoes were found near each of the tubes, but without war-heads on them. The port tube had

the depth-regulating apparatus in readiness. The outer cap of one of the tubes was still open. The tubes had been bent by the grounding of the ship. They were not loaded.

c. Vizcaya.

(*z*) The Vizcaya, like the Almirante Oquendo, is so seriously damaged that there is no prospect of hauling her off. This ship also ran ashore at great speed, and the keel was apparently broken in two, for with each sea the stern would rise and fall with loud creaking and groaning. The vessel was lying almost upright with only a small list to port. All the rooms below the protective deck, and the after rooms above it, were flooded.

Near the forward turret an explosion had taken place in the lower part of the ship, probably in one of the ammunition rooms. The wooden part of the upper deck had been burned and the iron plating torn open, and through the gap could be seen a chaos of broken anchor gear, capstans, chains, cement, rubbish, torpedo tubes, etc. The hull is about equally damaged on both sides.

α. The protective deck had been ripped open and the plating folded back on the starboard side, between the forward smoke-stack and the ship's side, probably as the result of a boiler explosion. The pivot sockets of the 14-centimeter rapid-fire guns had been torn away and the guns bent back to such an extent that the bores were pointing upward almost vertically.

β. Hot coal gas and smoke issuing from an open bunker hole showed that the coal was still burning.

γ. The Vizcaya had suffered little from hostile fire. A 15 to 20-centimeter shell had struck the forward broadside torpedo room, dismounted the port tube, and had apparently killed a number of men. Several charred bodies were found scattered over the whole room.

A 20-centimeter shell, ranging forward, had passed through the ship's side, through a locker amidships near the second 14-centimeter rapid-fire gun, and through a lateral bulkhead abaft of the forward turret; then, striking the turret, had glanced off without causing any impression, and exploded on the starboard side.

A heavy shell had entered the gun deck forward of the after turret and passed out through the starboard side without bursting in the ship.

Besides these three large-caliber hits, about twelve smaller ones

could be noticed in the broadside, most of them of 4.7 and 5.7-centimeter caliber; also five hits in the forward and one in the after smokestack.

Other observations were made as follows:

The conning tower had not been damaged by projectiles, but completely burnt out on the inside. The conning bridge was totally demolished. Two charred bodies were found still lying in the tower, also several bodies or parts of bodies in different places on the iron gun deck. Many rapid-fire cartridges, either whole or in part, were found scattered about; also a quantity of exploded small-arm ammunition.

The breech-blocks of two 14-centimeter rapid-fire guns were found near the guns. In one of these guns the projectile had been jammed near the muzzle. The whole cartridge was found in one of the bores. The breech was open.

δ. The torpedoes had not been made ready for use and the tubes were not loaded.

15. If we compare the observations made by the officers of the Geier as to the number of hits with the results of the examination made immediately after the battle, we obtain the following figures:

Hits from—	Maria Teresa.	Oquendo.	Vizcaya.	Colon.
10-cm. projectile	1	5	2	.....
12.7-cm. projectile	5 IV	5 III	6	4
20-cm. projectile	3 } III	3 IV	4 III	.....
30.5 / 33 cm. projectile	2 }	.....	.....	.....
Secondary battery	20 XV	42 XL	11 XVIII	.....

In the above table the Arabic figures designate the results of the United States Board, while the Roman figures represent the observations made at the time of our inspection in August last. It will be noticed that there is not much discrepancy in the figures. Of course, observations made so long after the action can not lay claim to absolute accuracy, especially as our sojourn on board was necessarily short. The traces of many hits have been partly obliterated by the powerful action of the surf, especially in the superstructures, of which hardly anything is left standing. It may therefore be inferred that the figures of the United States Board are more nearly correct than ours; but even they probably fall short of the actual results.

16. The Brooklyn was hit about twenty times by shells and several times by fragments and machine-gun projectiles. The cruiser sustained no serious injuries of any kind. The Iowa is said to have been hit twice in the bow, just above the water-line, by 15-centimeter shells and seven times by small-caliber projectiles. The Texas and Indiana were hit twice by light projectiles without sustaining serious injuries.

17. In order to be able to realize the complete defeat of the Spanish fleet it is necessary to call clearly to mind its situation in Santiago harbor. Cervera had entered the harbor on May 19. As early as May 27 five hostile cruisers with several gunboats and auxiliary cruisers were observed in front of the harbor, and there was no longer any doubt that the whole American battle fleet was blockading the harbor. Then followed the bombardments of Morro Castle and the Socapa, several shells falling into the bay, and the Spanish ships retreated closer to the city. On June 3 the Merrimac was sunk, but the entrance remained unobstructed. On June 22 occurred the landing of the American troops, who on July 1 attacked the fortifications of the city. Five hundred men of the landing corps of the Spanish ships took part in the defense and are said to have fought very valiantly.

18. The government authorities at Havana were very anxious to have the fleet leave the harbor, in order to remove the main object of the attack upon Santiago; for the ships had been the cause of the blockade and of the attack on the unprepared city. Hence it was imperative that the ships should leave. It is probable that ever since the middle of June this had been suggested to Admiral Cervera by the authorities at Havana; but the Admiral appears to have declared that it was impossible to make an attempt to run the blockade at night. Whether direct orders were finally given to leave the harbor under all circumstances I have not been able to ascertain.

19. Admiral Cervera was in a very difficult position. He was expected to act in some manner. He did not dare make the attempt at night, and so he decided to go out with his fleet in broad daylight. The whole crew fell a victim to this fatal decision. Instructions for the order of the sortie and the taking of the western course had been previously issued by the chief of the fleet. According to the Revista General de Marina, Vol. XI, No. 3, August, 1898, the Admiral was entirely convinced of the impos-

sibility of defeating the enemy or of reaching another Cuban harbor, even if he should succeed in steaming right through the hostile fleet. It is to this feeling of helplessness and impotence as against the American naval forces more than to anything else that I attribute the defeat. The Spanish ships had spent a month and a half in the harbor without even attempting to attack the blockading fleet when a favorable opportunity presented itself, or even of harassing it. The two torpedo-boat destroyers were not used for the purpose for which they were intended. This inactivity and lack of initiative must have had a very demoralizing effect on the officers and men. If we add to this the certain knowledge that the opposing forces were much stronger, it will be readily understood that the idea of general flight after coming out of the harbor entrance was the only acceptable one, especially in view of the possibility of beaching the ships, thereby rendering them unserviceable, and eventually rescuing the crews. From the very moment that this feeling of impotence took possession of the Spanish and led to the above reflections their fate, psychologically speaking, was sealed. We do not mean to disparage their valor and tenacity in the midst of the hostile fire; but, on the other hand, it is quite natural that the Admiral, seeing that everything was happening as he had foreseen, was the one who set the example of running his ship ashore. All the other commanders followed this example.

20. On the American side the situation was just the reverse. Admiral Sampson's fleet was fully conscious of its power. The blockade was being conducted in accordance with carefully prepared plans, as were also the arrangements in case of the enemy's attempt to escape. Frequent engagements with the Spanish forts had given commanders and crews that calm and assurance in the handling of their weapons which guarantees success. The long blockade service, exhausting and monotonous, hardly interrupted by any action on the part of the Spanish, had strung the nerves to the highest pitch, and everybody was anxious for the end to come. Suddenly the enemy attempts to escape. All the passions that had been smoldering under the ashes break forth. The welcome opportunity for settling accounts with the enemy had come at last, and with a wild rush the American ships fell upon their victims. At the beginning the American fire, owing to the excitement of the personnel and the great distances, was probably

not very effective; but when the Spanish Admiral turned to westward and the other ships followed him the moral superiority of the Americans reasserted itself. The commanders, calm and cool-headed, had their ships follow the same course, and the Americans, having every advantage on their side, recommenced the fire on the fleeing ships, which soon resulted in their total annihilation.

21. I have already spoken of the lack of training of the Spanish crews, the neglect of gun and torpedo target practice, the inadequate education of the commanders of the ships and torpedo-boat destroyers. It is mainly due to these deficiencies that the defeat was hastened and that the American ships sustained so few losses. Furthermore, there can be no excuse for having allowed the cruiser Cristobal Colon to leave Spain without her heavy armament. It has also been stated that the rapid-fire guns of this cruiser were unserviceable, so that she was really completely defenseless. The training of the engine personnel also was totally unreliable, which is not surprising in view of the fact that the Spanish ships, as a rule, are not sent out on extensive cruises. The bottoms of the Spanish ships had not been cleaned for a long time, and as they had been lying in Santiago Harbor for a month and a half they were considerably fouled. Thus the cruisers Maria Teresa, Oquendo, and Vizcaya, which in all official books are credited with 18.5 knots speed, went into the battle with a speed of from 10 to 12 knots at most, and the Cristobal Colon, which is the latest ship and was to run 20 knots, hardly attained a speed of 13.5 knots. Under these circumstances, in every way unfavorable for the Spanish, whose crews were insufficiently trained and physically and morally enervated by long inactivity, whose ships were inferior in number, speed, and fighting efficiency, it is no wonder that the victory of the Americans was easy and paid for with insignificant sacrifices.

22. There was only one chance for the success of the sortie. It should have been made at night in scattered formation. After a personal investigation of the locality, it is my opinion that it is entirely practicable for a fleet to leave Santiago harbor at night. The wreck of the Merrimac did not constitute an obstruction. It is true that Admiral Sampson's report on the night blockade states that the light-ships were lying from 1 to 2 miles from Morro Castle, according to the state of the atmosphere, and that

they lighted up the channel for half a mile inside. Even the best search-light, however, does not reach farther than 1 mile. Therefore the illumination could not have been very effective. Moreover, the shore batteries, by opening fire upon the light-ships, could have compelled them to change their positions; but, strange to say, this was never done. The dark nights at the time of the new moon about the middle of June would have been best suited for the enterprise. Besides the four vessels of the fleet, two large Spanish merchant vessels lying in Santiago harbor might have been taken out in order to deceive the enemy. The six vessels, with lights darkened, should have followed each other out of the harbor entrance, in predetermined order, as fast as possible. They should then have steered different courses, previously determined, with orders not to fight except when compelled to do so by the immediate vicinity of a hostile ship or when there was no possibility of escaping the enemy in the darkness. A rendezvous should have been fixed for the next day, where the ships that succeeded in escaping were to assemble.

23. If the fleet did not dare attempt a night sortie and was nevertheless compelled to leave the harbor in obedience to orders, then the ships should have been headed straight at the enemy. All weapons, including the torpedo and the ram, should have been used. A bold attack in close formation was the only chance of success against the superior hostile fighting forces, who would hardly have found time to form their lines.

24. I shall not attempt to discuss at length all the lessons which may be derived from the battle, because this would lead too far. I will only enumerate them, and confine myself to dwelling a little more fully on those which are of the greatest importance for practical service.

(*a*) Abolition of all woodwork.

(*b*) No unprotected torpedo tubes.

(*c*) Protection for all gun crews against shell fire.

(*d*) Protection of the fire-extinguishing apparatus against shell fire.

(*e*) Smokeless powder; greatest possible simplicity in the service of the guns and greatest possible rapidity of fire.

(*f*) Good speed of the ships under normal conditions.

(*g*) Thorough training of the crews in all branches of the service.

25. The last two are the most important. A ship may show very brilliant results at the trial trip and be credited with the greatest speed in the different books on the navies of all nations; but for the officer who is to command the ship in battle this is not a criterion from which to judge of her efficiency. Frequent trial trips under full steam, making it possible to discover and cure defects of the machinery in time of peace, and familiarizing the personnel with the functioning of the vessel in all its details, can alone give the commander an idea of what he may expect of his ship in battle. Extensive cruises at war speed should also be made, in order that the personnel may get an idea of how much more will be required in time of war. This is especially important in the tropics, where the great heat materially affects the physical endurance and efficiency of the boiler and engine personnel.

26. The most perfect training of the crews in all branches of the service, especially by all kinds of torpedo and gun practice, as nearly as possible under war conditions, is the foundation of success. As I said in Part IV of this work, nothing should be left undone to attain the greatest perfection possible in time of peace. No expense should be spared to enable those who bear the responsibility of the battle—the chiefs of fleets and squadrons, as well as all commanders—thoroughly to test the actual degree of efficiency of their crews by practical exercises, resembling as nearly as possible the operations of actual warfare.

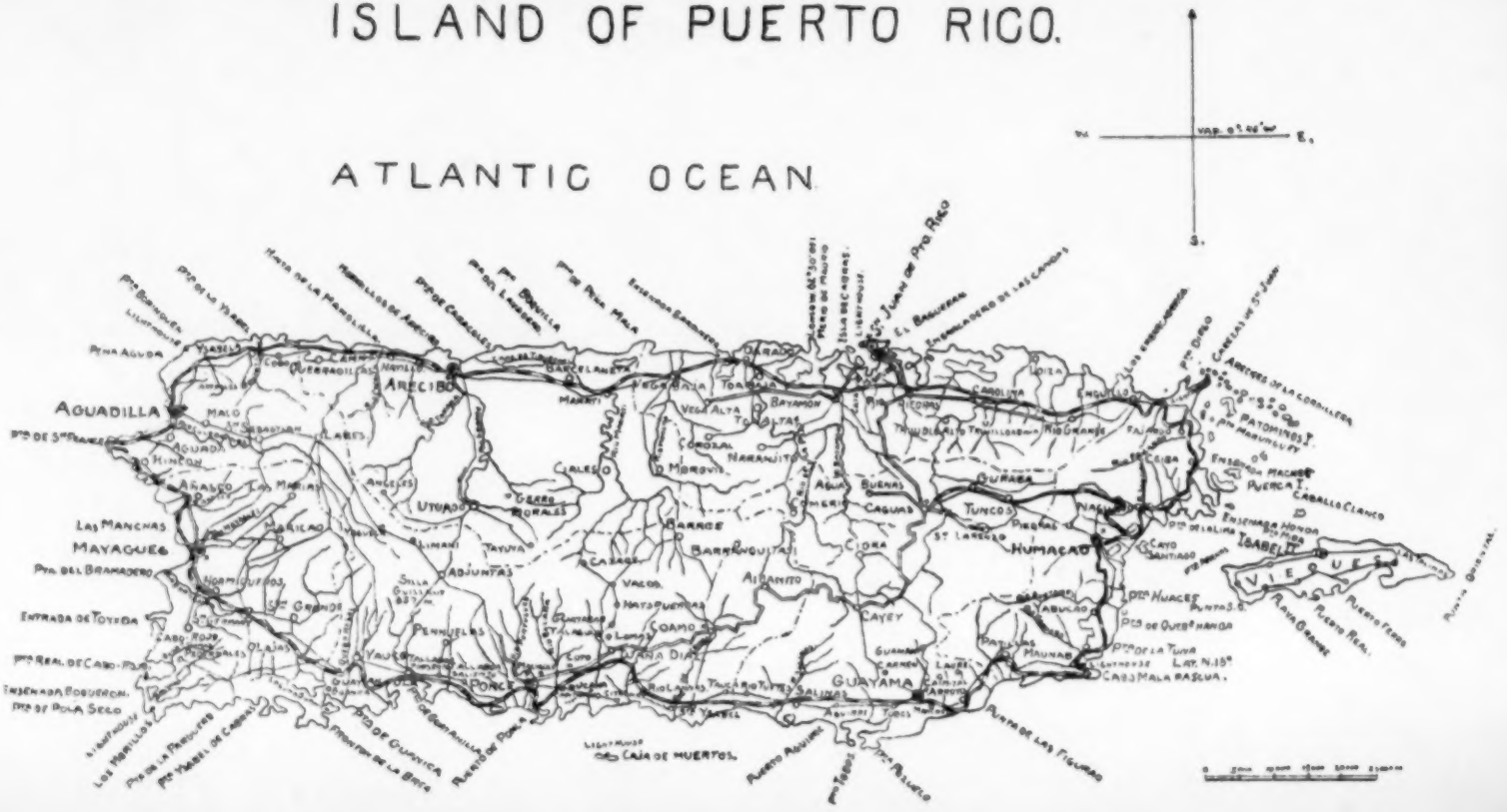
27. Such exercises will also demonstrate whether the weapons, from a technical standpoint, are equal to all the exigencies of war. I learned, for instance, that the following defects were found to exist in the American artillery matériel:

(*a*) *Brooklyn.*—In the 5.7-centimeter rapid-fire guns cartridges were jammed in several instances. In the 20-centimeter guns the plugs stuck several times. Some of the 12.7-centimeter rapid-fire guns became unserviceable toward the end of the battle because the elevating gear did not function properly, and all these guns had to be supplied with new mounts after the battle.

(*b*) *Texas.*—The two 30.5-centimeter guns had been fired several times across the deck, considerably damaging the latter. A suggestion made in time of peace that the guns be tested in that respect had not been followed out.

(*c*) *Iowa.*—On this ship, also, the deck had been damaged by

ISLAND OF PUERTO RICO.



the firing of the heavy guns. The training gear of the 20-centimeter guns had not been able to sustain the firing at great elevation.

The most careful examination of the artillery matériel in time of peace is absolutely necessary. Even when the strictest requirements are made and fulfilled in testing the guns, it is no guarantee that the matériel will not in the course of time show defects on board ship. In order that such defects may not remain hidden, to become apparent only when the guns are used in actual war, at least part of the target practice should be held with full service charges.

VII. The Occupation of Puerto Rico.

1. In my first visit to San Juan de Puerto Rico (see Part III of the Sketches), I found there, to my great astonishment, a comparatively large German colony. I learned that in all the principal towns on the island, such as Ponce, Mayaguez, Aguadilla, and Arecibo, Germans are likewise settled, and in the possession of large business houses, enjoy the esteem of the Spaniards as well as of the Puerto Ricans. Under these circumstances it appeared necessary to send thither a warship for the protection of the Germans when the Government of the United States commenced action against Puerto Rico. I have successively visited the harbors of Mayaguez, Ponce, and San Juan. The first two were already occupied by the Americans, while the third city was still in the hands of the Spaniards. On the 13th of August it became known that peace negotiations had commenced, and hostilities ceased.

No great battles were fought in this campaign; only a few minor skirmishes took place. But the American troops were marched up in such a simple and skillful manner that the operations are not without interest. Moreover, our readers will be glad to learn some particulars about this beautiful island, in which these many years German merchants, mostly from Hamburg and Bremen, have exerted their best energy in steady, unremitting toil, and which now, as the price of victory, falls into the lap of the United States.

2. The accompanying map of the island is the latest and best published. It shows the different departments, so that a descrip-

tion is not necessary. All the turnpikes and roads which are to be considered in connection with the advance of the American troops, as well as the railroad skirting the coast, are also indicated on the map. The mountain range which extends nearly parallel to the southern coast from Adjuntas to Cayey is, on an average, not over 1000 meters high, and from both towns is continued in several spurs to the eastward and westward. This range constitutes a weather barrier, as the fresh northeast trades cool the northern part of the island and provide abundant rains, while in the southern part of the island the mountains prevent this moderation, and the heat often becomes unbearable. Numerous streams water the fertile soil, which in former years produced mainly sugar, but now also coffee, tobacco, and bananas, and furnish large areas of magnificent pastures. The number of inhabitants in round numbers is 800,000. The area of Puerto Rico is about one-tenth that of Cuba, which has hardly 1,500,000 inhabitants. The whole island of Puerto Rico is inhabited. There are no extensive uncultivated stretches, as in Cuba. Still, much remains to be done to obtain better yields than heretofore from the rich and fertile soil. In the first place the agricultural methods should be improved, better communication established with the coast, and, finally, the mineral treasures of the island exploited. In this latter direction hardly anything has been done. As far as the social conditions of the island are concerned, it has been spared the serious disorders that have been raging in Cuba during the last few decades. The Spanish, by means of military posts distributed all over the island, and especially the Guardia Civil, an excellent police system, have succeeded in maintaining order and safety throughout the country. There have been minor disturbances, it is true; but at no time has there been an actual rebellion against the Spanish Government, such as was spoken of at the beginning of the Spanish-American war. Nevertheless, there has gradually developed among the Puerto Ricans an intense hatred toward the selfish Spanish administration, and with open arms they received the Americans who came as liberators from the Spanish yoke.

3. The general opinion, reinforced by the United States press, was that the troops would land east of San Juan, probably at Tajardo. General Miles was the only one who was informed as to the landing place selected, and he left Guantanamo on July

21, with the auxiliary cruiser Yale and seven transports with about 3500 men. The battleship Massachusetts, the cruiser Columbia, and six small gunboats and auxiliary cruisers, among them the Dixie, Annapolis, and Gloucester, accompanied the transport fleet. Upon reaching Mona Passage the fleet headed for the southern coast of Puerto Rico, and on July 25 the troops were landed at Guanica without encountering serious resistance. The very next day, after a short fight with the Spanish, Yauco, which controls the railway to Ponce, was occupied.

On July 27 the Dixie, Annapolis, and several other vessels appeared in front of Ponce and demanded the surrender of the city. The United States general granted time until the next morning, and told the commander of the city that unless the surrender had taken place by that time he should at once proceed to bombard the city, and land his men. Captain-General Macias, at San Juan, had given the commander strict orders to defend the city to the utmost, but the combined efforts of the foreign consuls prevailed upon Colonel San Martin to agree to the surrender of the city on condition that the Spanish troops would not be pursued for forty-eight hours. This agreement, however, of which the United States commander had already been notified, was declared null and void by Captain-General Macias, who at the same time discharged Colonel San Martin from office, and it was only due to the energetic efforts of the German and British consuls that the captain-general became convinced of the necessity of surrendering, and finally consented to the evacuation of the city. Thus the Americans took possession of Ponce at 6 a. m. on July 28, without loss of life or injury to property, and on July 29 they landed a large division of troops, consisting of from 5000 to 6000 men, with artillery and wagons. On August 1 two vessels occupied Arroyo, where about 3000 men were landed.

4. Thus the Americans in a short space of time had gained possession of the three principal harbors on the southern coast of Puerto Rico without firing a single shot. They owe this, first of all, to the friendly disposition of the population and the lack of energy of the Spanish officers, who did not dare offer any resistance. General Miles's subsequent plan of campaign is self-evident. The troops landed at Arroyo were to advance upon Guayama, thence to Cayey, which lies on the main road to San Juan. The fighting forces at Ponce were also to advance upon Cayey

by way of Juana Diaz, Coamo, and Aibonito. The troops at Guanica were to advance by way of Yauco, San German, and Hormigueros, and occupy first Mayaguez, then Aguadilla and Arecibo. A glance at the map will show that this plan would compel the Spanish forces, in order not to be cut off, to retreat to San Juan. When all the United States forces had been concentrated at San Juan, they were to surround the city, supported by the blockading fleet, and it was here that the decisive blow was to fall.

5. General Miles's plan of campaign was carried out as intended. On August 8 General Schwan advanced from Yauco upon San German. At Hormigueros they were opposed by the Spanish, who with 1000 men occupied an excellent position; but as soon as the American artillery was lined up and the American lines advanced the Spanish evacuated the heights and retreated. On August 11 General Schwan took possession of the town of Mayaguez, which had been evacuated by the Spanish, and met with a hearty reception from the inhabitants. The American troops pursued the Spanish and succeeded in surprising them on August 12 at Las Marias. The Spanish troops were resting, without any special measures of precaution, on the bank of the Guasio River, when the Americans were discerned on the heights. As the river was very high from recent heavy rains, the Spanish had difficulty in crossing it. The American commander demanded their surrender; but it seems that the Spanish had opened fire, thereby compelling the Americans to answer with their artillery. This caused great confusion in the Spanish lines. Two companies only succeeded in crossing the river, the others had to surrender. The Spanish had 40 killed and wounded. Among the many prisoners who were taken to Mayaguez were several colonels and captains.

On August 4 the main body of the troops advanced on the excellent road from Juana Diaz, a small town about 25 kilometers from Ponce. On August 9 they took Coamo, which the Spanish were holding with a force of about 1000 men. The fight lasted five hours, and ended in the evacuation by the Spanish, as the Americans had succeeded in going around the enemy's flank. The Spanish had 15 killed, among them the commander-in-chief and several officers. About 150 were taken prisoners. The Americans had 7 wounded. The Spanish retreated to Aibonito,

where they intrenched themselves in a fortified position. They were not effectively attacked here, because hostilities were suspended about that time.

The third division of the American troops had advanced from Arroyo and taken Guayama on August 5. On August 8, while advancing toward Cayey, the Americans had a slight engagement with the enemy intrenched in a fortified position, ending in the retreat of the latter. But the American troops had to return to Guayama, because they did not consider themselves strong enough to accomplish the task set them—viz., to advance as far as Cayey. When, on August 12, the Americans started a second time, they found the Spanish in the same fortified position. No fight took place, because the news arrived that peace negotiations had been entered into.

6. According to the census of January 1, 1898, the Spanish had the following troops in the different departments:

ARMY.

	Generals.	Commanders.	Officers.	Men.	Total.
San Juan	2	39	136	2,217	2,394
Arecibo	.....	1	15	253	269
Aguadilla	.....	2	13	313	328
Mayaguez	.....	3	51	1,101	1,155
Ponce	.....	5	51	1,317	1,373
Guayama	.....	4	44	997	1,045
Numacao	.....	1	16	320	337
Vieques	.....	1	4	96	101
Total	2	56	330	6,614	7,002

NAVY.

	Admirals.	Commanders.	Officers.	Sailors, mechanics and firemen.	Marine infantry.	Total.
San Juan	1	9	20	287	22	339
Arecibo	.....	.....	1	3	.....	4
Aguadilla	.....	.....	1	2	.....	3
Mayaguez	.....	1	.....	4	.....	5
Ponce	.....	1	.....	5	.....	6
Guayama	.....	.....	1	2	.....	3
Numacao	.....	.....	2	4	.....	6
Vieques	.....	.....	1	1	.....	2
Total	1	11	26	308	22	368

The volunteers have not been included, because, with very few exceptions, they laid down their arms as soon as the Americans landed in Puerto Rico.

7. In Puerto Rico, as well as in Cuba, no plans had been made for concentrating the troops at the beginning of the war. The fighting forces were so small that landings of the enemy at any point on the coast could not be impeded. The troops, by remaining in their different departments, might find themselves under the necessity of having to fight far superior hostile forces, and finally to retreat within sight of the enemy in order not to be cut off. The best plan would have been to concentrate all the troops in a fortified position near Cayey, keeping up retrograde communication with San Juan. If the enemy had landed east or west of San Juan, it would have been easy, in view of the good road, to effect a change of front or for the whole force to retreat to San Juan, which was the most important point of the Spanish. If that city had been defended by 7000 men, it could have resisted the enemy for a long time. It is true, however, that without the prospect of assistance from the navy, the final surrender of the city, as the result either of the harbor being forced by the enemy or of starvation, would have been only a question of time.

8. At the time of our arrival at Mayaguez hostilities had just been suspended. General Schwan had taken charge of the administration of the department. The inhabitants were entirely satisfied with the new order of things, but many families were mourning the fatal defeat of the Spanish troops at Las Marias. The prisoners taken by the Americans had been quartered in the barracks and were being strictly guarded. We had to abandon our attempt to inspect the scene of the battle because the road, owing to the recent rains, was in very bad condition and obstructed by the numerous baggage carts of the American troops. But in order to gain at least an idea of the immediate surroundings of Mayaguez, I drove to Hormigueros, where the first engagement had taken place between American and Spanish troops. A well-kept road follows the coast over almost level ground, passing through several small hamlets. Soon the scenery changes. Cane fields resplendent in their fresh verdure are seen in every direction, and beautiful hills closely covered with banana palms and coffee trees appear before our eyes and gradually rise higher and higher.

In the distance the river may be seen, crossed by a number of iron bridges, over which the railroad passes that runs along the river. The road rises very gradually, and after we had passed over the top of the range of hills we saw at our feet the pretty town of Hormigueros. At its highest point stands the church, from which one must gain a magnificent view over the whole region. We went there, and after mounting the stone steps into the belfry, we saw before our eyes a panorama of indescribable loveliness. Indeed, a better point could hardly be found from which to gain an idea of the exquisite beauty of Puerto Rico. Far as the eye can see stretch the picturesque ranges of hills clad in the loveliest green; at their feet a few scattered cottages and small hamlets, and glistening streams winding their way through them. But we could not allow our eyes to be completely captivated by the natural charms of the country. We had also to satisfy our military curiosity. One thing became evident at a glance, namely, that the church was the best tactical point of the whole region, as all the different positions could be observed from there. The Spanish commander-in-chief appears to have realized this circumstance; for, as the kindly priest of the church told us, it had been his intention to occupy the church and line up his artillery on the adjoining hill; but the priest had succeeded in dissuading the commander from this plan, which would surely have entailed the destruction of the church and town. Probably no serious resistance had been planned by the Spanish, and they were therefore only occupying the range of hills between which a defile leads to the town of Mayaguez, to which the troops retreated as soon as the Americans commenced to advance after the first few volleys. In the little town of Hormigueros peace and quite were reigning. The Americans had already appointed a mayor. A few families from Mayaguez had come hither to await further developments. On my return to Mayaguez I had an opportunity of inspecting a company of United States volunteers. They were nearly all tall, robust men, most of them with healthy complexions and of good military bearing. All the volunteers were equipped with Krag-Jörgensen rifles.

9. On August 16 we left the harbor of Mayaguez and steamed to Ponce, where we arrived in the evening of the same day. The harbor was crowded with American warships, auxiliary cruisers,

and transports; but as a result of the peace negotiations, many of the warships had received orders to return to Guantanamo or to proceed to the United States, so that the harbor was considerably cleared during the next few days. General Gilmore, in the absence of General Miles, who was then at Coamo, had established the headquarters of his staff at the custom-house. The United States garrison was encamped near the harbor on both sides of the main road leading to Ponce. The camp consisted of ordinary tents, with camp beds raised a few feet above the ground. As it always rained several hours during the day and usually all night long, one may easily imagine the condition of this camp. Men were constantly at work digging new drains for the water. At times the guards and patrols surrounding the camp had to wade in the mud up to their knees. It is a wonder that there was not more sickness in the camp, for the American general told me there were only a few cases of malarial fever. But exposure to the burning rays of the sun, to constant rains, and the exhalations of the soil is extremely dangerous in this climate, as the residents know only too well, and cannot fail but have its injurious effects sooner or later. As a matter of fact, many cases of fever have subsequently developed among the American troops. I cannot understand why the military authorities had not exercised greater care. Would it not have been better to send the troops to Coamo, which is located on much higher ground, leaving only a small garrison at Ponce? Such a garrison would have been quite sufficient for the protection of the latter town, and might have been quartered in public buildings, such as the church, the theater, etc. The United States transport steamers are said to have had on board all the material necessary for the construction of a small shipyard. If it is true that they carried their preparation to that extent, then better provisions should also have been made for taking care of human lives. If it was not deemed advisable to quarter the men in the towns, then corrugated-tin barracks should have been taken along, which can be taken apart and speedily erected on piles driven into the ground. Ordinary tents were certainly inadequate.

10. On one of the following days we made an excursion to the vicinity of Coamo, about 30 kilometers from Ponce. The beautiful, wide road extending all the way to San Juan is a true work of art, and makes it possible to advance rapidly. The whole dis-

tance from Ponce to San Juan, about 135 kilometers, can be made in vehicles, by changing the horses twice, in fourteen to sixteen hours. The rise is very gradual. On both sides are small huts of natives with corrugated-tin roofs, or covered simply with palm leaves and built on piles about 1 meter high. Soon we came out upon the open country, where wooded hills and valleys alternated with coffee plantations and banana and sugar-cane fields. The profuse tropical vegetation, especially the slender palms with their magnificent crowns, is a constant delight to the eye. After the rain, which had been falling all through the preceding night, the foliage was particularly green and fresh and the shady road nearly free from dust. In several places the road is crossed by the river, which can usually be forded. Where it is too rapid bridges have been built. Upon reaching Juana Diaz the landscape becomes even more beautiful. The heights afford a splendid view of the whole region from the coast to the high mountain range. At Coamo we left the main road and soon reached a beautiful valley made famous by the "Baños de Coamo." There is a large hotel for the accommodation of visitors. The bathing establishment also is very conveniently arranged. A natural spring furnishes sulphur baths. The only thing that reminded us of war during our trip were a few squads of American cavalry and long trains of wagons, each drawn by six mules, which were taking the necessary supplies to the troops encamped at Aibonito. From what we could learn, it seems that the American authorities were preserving excellent order and safety at Ponce and vicinity, but the Puerto Rican inhabitants showed their hatred for the Spanish so openly that, in spite of the strict measures taken by the Americans, there is danger of demonstrations by the inhabitants in that direction.

11. On August 23 we made a second visit to San Juan. The mines in the entrance had been removed and the channel was marked by buoys in the usual manner. Besides the Spanish gunboats Isabel II., General Conche, Creola, and Ponce de Leon, and the torpedo-boat destroyer Terror, there were neither war nor merchant vessels in the harbor. The city itself presented the same aspect as before the blockade. It was not until the latter part of August that steamers arrived and commerce and traffic were re-established. I took advantage of our presence there to learn further particulars about the engagement between the tor-

pedo-boat destroyer Terror and the United States auxiliary cruiser St. Paul. The commander of the Terror gave me the following account of the battle:

At 9 A. M. on June 22 the lookout at the fort signaled a suspicious vessel. The commander gave orders for the Isabel II. to go out to reconnoiter and for the Terror to be ready for action. By 11.30 the vessel had come closer and the Isabel II. went out. Upon sighting her, the hostile cruiser immediately hoisted her flag and waited. The Isabel II. opened fire on the foe. The destroyer then received orders to go out and assist the Isabel. The Terror, which had been left by her fleet at Martinique, had not been able to recover her guns and ammunition, which during the voyage had been transferred to the Maria Teresa in order to make room for coal. The Terror therefore had no other weapons than her torpedoes and two 57-millimeter guns, with little ammunition. The Isabel fought the St. Paul at a distance of from 10,000 to 12,000 meters. As the utmost range of our guns was only 4000 meters, we could not assist the Isabel by going closer to her. I therefore gave orders to head the Terror east, so as not to interfere with the Isabel firing north on the enemy. When we were sufficiently clear of her and had the open sea before us, I headed straight for the St. Paul at a speed of from 20 to 21 knots.

The enemy, who hitherto had been firing on the Isabel, now directed upon us the well-aimed rapid fire of both of her batteries, the lower one of which appeared to have eight, the upper one ten to twelve guns. At 4000 meters we opened fire with our guns, in order to keep up the spirit of the crew during the interval between the beginning of the hail of projectiles and the launching of the torpedo. Our fire was very accurate. At the first shot we saw the shell explode on the stern. Several other shots also hit their target, and our men were wild with joy. We had approached to within 1200 meters and were about to launch the torpedo when the Terror commenced to veer to starboard. I had the helm shifted to port, but the ship kept on turning. Then I ordered the port engine stopped, and still the ship continued to turn to starboard. I then learned that a shell had exploded on deck and destroyed the leads to the steering gear and telegraph, so that the vessel followed the movements of the screw and was unmanageable. The hand-steering gear was at once put in operation; but as we passed the enemy at such close range, several projectiles hit us, one of them passing through the port side into the engine room, where it burst. The engine room became flooded and the engine appeared to have been disabled. We just managed to steam into the harbor.

From an inspection of the Terror it appeared that the fatal shell, ranging obliquely downward, had passed through the ship's side, torn off a steam gauge, killed three men, and struck the lower edge of the main steam pipe, tearing off its covering. This had deflected the shell, and it had passed out through the starboard

side. It was through the hole made by the projectile in passing out that the engine room had been flooded up to the lower edge of the steam cylinder; but the engines continued to run, so that the Terror, though with gradually slackened speed, was able to reach the harbor under her own steam. The shortest distance between the Terror and the St. Paul had been 800 meters. The gunboat Isabel II., I was told by her commander, had not gone closer than within 6000 meters of the enemy.

12. We then visited the fortification works and made the following observations, which may be considered as a supplement to the description of the bombardments contained in Part III of these Sketches:

(*a*) *Morro Castle.*—On the highest terrace are three 15-centimeter Ordoñez guns of 30 calibers length and two 24-centimeter breech-loading howitzers of modern type; direction of fire northwest to west. On the next lower terrace are two 15-centimeter Ordoñez guns. These are all the guns that had been mounted. No guns were dismounted during the bombardments. The walls of the fort are over 6 meters thick and extremely solid. They show many hits of heavy, medium, and light artillery. The heavy projectiles had entered the walls to the depth of 2 meters and torn large pieces out of the masonry work. The smaller projectiles had done very little damage, which had already been repaired. One shell had struck the corner of the wall on the lower terrace and killed two of the men serving the guns and wounded several others by shell fragments and débris.

(*b*) *Cristobal Castle.*—Two 15-centimeter Ordoñez guns of 30 calibers length, trained north, fired about eighty rounds during the bombardment. A little to the rear are three 24-centimeter breech-loading howitzers of modern type. At one of these an enfilading shot passing over Morro Castle had struck the breech and killed one man. As a result of this accidental hit, and to protect the men serving the farther guns against shell fire and débris, earth traverses had been thrown up between the guns after battle. A little further back and to the east three 15-centimeter guns, with an arc of fire north by way of east to southwest, and hence also adapted to fire on the land, were mounted on central-pivot carriages. These took part in the fight with about thirty rounds. Finally, at the Princesa Battery, adjoining Cristobal Castle on the east, there are four more 15-centimeter guns and

two 24-centimeter howitzers. Cristobal Castle and the Princesa Battery sustained only a few hits, slightly damaging the outer walls.

(*c*) The howitzer and gun batteries of the harbor entrance show no serious injuries. Morro Castle appears to have been the main object of the American fire. The fact that many shells did not explode has been much commented upon.

(*d*) Besides the fortifications mentioned above, the Spanish had erected a new battery at Escambron, with three 24-centimeter howitzers of modern type in central-pivot mounts, for indirect fire. For land defense a series of earthworks had been erected near San Antonio and armed with mortars and bronze guns.

13. As we left Morro Castle Spanish soldiers were engaged in taking down the shield with the Spanish coat of arms over the main entrance. As the remains of the ever-glorious Columbus had been removed from the cathedral at Havana, where they had a beautiful and well-cared-for resting place, so it was also desired to carry to Spain this escutcheon, which for centuries had been the witness of the victories and greatness of the Spanish nation. When both of these—the remains of the man to whom the whole world owes so much and the emblem of Spanish power—reach Spain there will be profound sadness throughout the whole country over the final loss of its colonies. The history of this short struggle is another example of the instability of power and fame in the ever-changing destinies of the nations of the earth!

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

SEAVEY'S ISLAND PRISON AND ITS ESTABLISHMENT.

By LIEUT. R. H. JACKSON, U. S. N.

The naval battle of Santiago left about 1700 Spanish prisoners on board the American men-of-war and auxiliary vessels.

What disposition should be made of them was now a problem.

The Navy Department solved it by selecting a site on Seavey's Island for a military prison and camp, and at once let contracts for building a stockade, erecting barracks, kitchen, closets, etc., bringing a water-supply to the camp, and furnishing provisions. All arrangements were made for the comfort and health of the prisoners, provided the contractors could fill their orders, and worked with dispatch.

Information having been received that the first vessel loaded with prisoners would arrive on Monday, July 11th, the Department wisely telegraphed Paymaster Loomis to proceed immediately to Portsmouth, N. H., and report to the commandant for duty as commissary of the camp and assume such duty at that place.

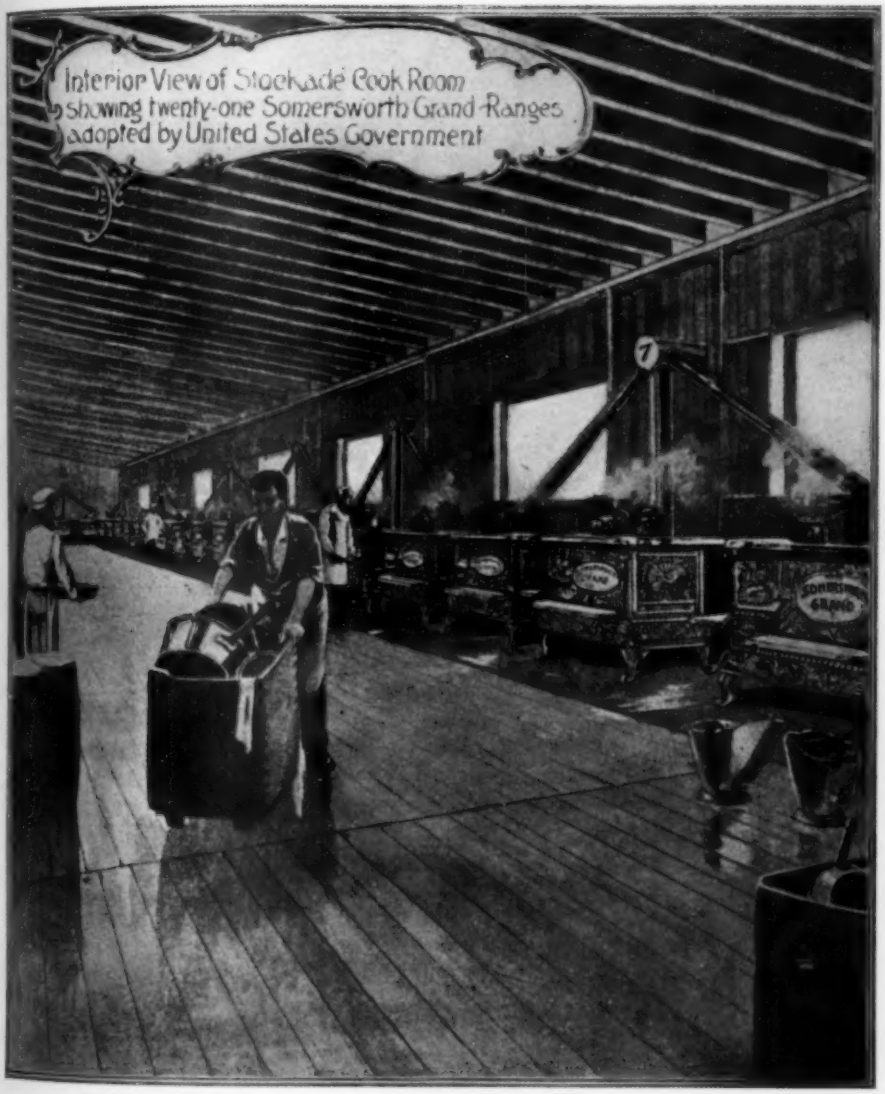
Taking the next train the paymaster arrived at Portsmouth Saturday morning, and having reported to the commandant, went out to the camp to see if everything was in readiness for the prisoners. What might be termed the quartermaster's and the commissary's departments seemed in need of most energetic measures. The kitchen or cook-house was only outlined by a few frames, and some flooring, and there was no sign of a stove, or shelter for stores and provisions when they should arrive. This was Saturday afternoon, and the prisoners were expected Monday morning.

Taking a steam launch post-haste for Portsmouth the paymaster rang up the Department at Washington (of Supplies and Accounts) over the long distance telephone. He reported that, though he was ready to furnish provisions and supplies for the prisoners, there was no place for cooking them, or storing a reserve supply. The substance of the reply was, that the Department wished every preparation to be made for the health and comfort of the Spanish prisoners, and it conferred upon him all authority to adopt such measures as would facilitate that result. Clothed now with full authority as quartermaster and commissary, the paymaster interviewed the contractor for the erection of quarters, storehouse and kitchen. "The kitchen must be under cover to-night, and the storehouse to-morrow," said the paymaster. "It can't be done, it is impossible," was the reply. "It must be done," said Loomis, and it was done. "Where are the stoves for the kitchen?" They were awarded to another contractor. So the stove-dealer was interviewed. "I want fires in the stoves to-morrow night," was the greeting. "Why, there is no place ready for them; moreover, the stoves are still in Boston." "The kitchen will be ready, and the stoves must be in place with fires lighted in them to-morrow night before I leave the stockade," was the ultimatum. Sunday night 21 ranges were in place, lighted and ready to roast and boil for 1700 men. Cooks were to have been furnished, but had not appeared on Sunday; so by a diligent search of Portsmouth Sunday afternoon, 10 were obtained.

The next morning the transport was sighted coming up the harbor; by noon 700 prisoners were mustered ashore and marched into camp, sitting down to a hot dinner of hot coffee, fresh beef, fresh bread, potatoes and onions, probably the first "square meal" of fresh food that they had enjoyed since sailing from Cape Verde Islands.

Immediately after landing each man received a hammock, mattress and two blankets. Hooks were arranged in the barracks, so that the men slung their hammocks at night and lashed and stowed them in the morning.

The meals were served at 7 a. m., 12 and 5 p. m. Meat was usually issued for breakfast and dinner; it was at first issued for all the meals, but it was found that a number were made ill by this excess over their accustomed allowance of meat—one meal


Interior View of Stockade Cook Room
Showing twenty-one Somersworth Grand Ranges
adopted by United States Government
7

only, or even none at all. Three tables were arranged near the entrance to the mess-hall, and the squads were marched in lines between them, pannikin in hands, and the servers-out helped each man to his portion, the men passing to seats at the table in the mess-hall; the time occupied in serving out a meal to the 1700 men varying from 10 to 20 minutes, according to the bill of fare, dinner always taking the longest time.

Better and more experienced cooks than those first obtained were gradually added by the Navy Department till the number reached 20. Then the Spanish cooks began to assist, in order to get the pickings and perquisites belonging to cooks the world over, so that the final number was about 30.

All needful clothing and even shoes were furnished them, the latter a luxury to which many, no doubt, were but little accustomed. At first the medical officers detailed by the Department attended to all the sick as well as to the sanitary condition of the camp; but Spanish medical officers were soon able to look after the bodily ills of the prisoners; and two Spanish priests, who were among the captives, looked after their spiritual welfare.

Drinking water was brought down in a pipe from a neighboring reservoir in sufficient quantities to supply the camp.

A line of closets was established overhanging the banks of the Piscataqua, and the kitchen sink drained into its swiftly running waters; so by vigilant policing, the camp could be maintained in a perfectly sanitary condition indefinitely.

Sentries were established on beats overlooking the stockade, along the water-front, at the water-supply, and at the barracks; bugle calls of reveille, meal-formation, taps, and barracks were introduced, and the routine went on without incident.

The officers were paroled, and spent their afternoons in Portsmouth, apparently enjoying themselves heartily.

The only danger apprehended was from fire—one who knows Jacky's fondness for a sly smoke in his hammock can readily appreciate this fact; and after tobacco had been issued to them, constant and successful effort was made to prevent smoking in the barracks.

The camp broke September 12th, and the prisoners sailed for Spain, healthier, stronger, and better fed than in all their lives; they are no doubt still recounting to open-mouthed and half incredulous friends and kinsmen how the Americans gave them

meat twice a day, and even shoes to wear. The cost of this good, wholesome food (and plenty of it) was found to have averaged, for the two months, 19 cents a day per capita.

The colonel commandant, who twice inspected the camp personally, reported:

"September 2nd and 3rd I thoroughly inspected the camp and prisoners, with the commanding officer of the marine barracks, Lieut.-Colonel Mead, who had a few days before relieved Colonel Forney, and I could hardly realize the great improvement which had taken place in the condition of these men. The prisoners were drawn up in two lines in their respective barracks, and I inspected every prisoner in the camp. Most of them were dressed in white suits, all the clothing was very clean, and the men looked well and contented. Their bedding was opened and found to be clean and neat. I also inspected the grounds, barracks, sinks, mess pavilion, and other buildings at the camp, and found them clean and in a perfectly sanitary condition, showing that great care had been bestowed upon the men and camp by Colonel Forney and Lieut.-Colonel Mead, as to health and comfort, since they landed at Seavey's Island."

For resource displayed in utilizing the material at hand, the perfection of details and promptness of execution, the establishment of this camp, though one of the minor incidents of the war, is deserving of great commendation; and the prompt initiative of the commissary, in his dual capacity of commissary and quartermaster, in forcing matters to a successful issue, when quick work is needed, is an example by which the service may well profit.

PROFESSIONAL NOTES.

THE LESSONS OF THE SPANISH-AMERICAN WAR.

The hostile operations between Spain and the United States, considered as a war, have not afforded many practical object-lessons to the naval strategist. It is a matter upon which we have mixed feelings. Object-lessons in war cannot be learned without much letting of blood on both sides; therefore, as simple humanitarians, we rejoice that so few lessons were learned during the late warlike operations; it would be almost too much to call them "war"; there was so little hitting back by one side. But our humanitarianism, like most of our qualities, good or bad, is compound rather than simple; so, with a balance of feeling in favor of our own countrymen, we would like such military object-lessons as may be needed by mankind to be paid for by the blood of others rather than by our own. If, however, we put aside our war standard, and compare the amount of instruction received on a peace basis—as represented by naval maneuvers, theoretical disquisitions, or that most problematical of guides, the war game—we find a wealth of instruction; enough to keep our naval strategists and tacticians busy for the next year or two, showing the results of the war to be proof of the soundness of their own special theories.

War has its consolations, just as peace has its victories, and they come to the warrior oftener than to the citizen. Amongst those to whom the Spanish-American war—for we must perforce give it its courtesy title—has brought most consolations, as a set-off against the inevitable unpleasantness of fighting, is no doubt Admiral Colomb. He is, every one knows, as amiable and gentle a sea warrior as ever longed to blow a ship's company into eternity, but before the war had progressed far he made some remarkably shrewd forecasts of what should happen, and, to his great glory and satisfaction, now that the war is over it is seen that things should have happened just as he foretold. That they did not, exactly, is beside the mark. The principles were sound, and if events did not justify them, that must be laid to the blame of events. In all seriousness, however, it may be said that the Spanish-American war has shown the soundness of the views that Admiral Colomb has put forward with so much perseverance through many years past. Years before Captain Mahan wrote, he industriously preached the great doctrine of naval supremacy and the futility of military preparations—more especially in the form of fixed defenses—unless supported by adequate naval force. He showed the small fear we need have of invasion so long as there was a "fleet in being," and impressed the wisdom of sending our fleet anywhere to seek an enemy's ships rather than keeping in home waters; or, in other words, that the best protection for our coast was to seek out and destroy the fleets of the enemy, all other operations being subsidiary to this first need for our existence as a great power among nations.

At the present time these principles have become almost truisms in the

popular mind, and the navy now receives the consideration it merits, and which expediency demands for it. This sounder policy is largely due to Admiral Colomb; far more so than the general public appreciates. If, as some think, he has occasionally overshot the mark in the enthusiasm of advocacy, his main contention has been sound, and the thanks of the country are specially due to him for his untiring and disinterested labors. On Wednesday, March the 8th, he contributed a paper to the Royal United Service Institution, in which he set forth some of "The Lessons of the Spanish-American War." Perhaps, some critics may be inclined to say, one of the most remarkable of the "lessons" is that Admiral Colomb has learned there may be some virtue in a fixed defense. He speaks of the difficulty of grappling telegraph cables in deep water and says: "The lesson appears to be that it is not impossible that if we were at war attempts might be made to damage us in that way (*i. e.* by cutting our cables in shallow water); and it seems a legitimate conclusion to assume that the ends of our cables ought to be covered and protected by a few of the longest-ranged guns properly mounted in a battery."

Admiral Colomb holds that the proper strategy of the Americans was to send a sufficient force to the coast of Spain. "The seizure of Minorca as a base would," he says, "probably have been an easy operation; and in any case it would have been morally certain that if this action had been taken nothing offensive on the other side of the Atlantic could have been thought of by Spain. Then for Cuba and Porto Rico, landings for conquest might have been effected at leisure." Unhappily for the Spaniards, "nothing offensive" was possible on either side of the Atlantic with their ill-served and ill-fitted ships, but that, of course, was not known at the time. The strategy Admiral Colomb advocates, supposes that America possessed a sufficient fleet to seal up the Spaniards in their ports, and also a surplus of ships capable of destroying any vessels Spain might have sent to West Indian waters; and which might have constituted "a fleet in being" absolutely forbidding—according to Admiral Colomb's own teaching—any operations of the nature of landing troops. That consideration, however, does not affect the wisdom of seeking the enemy's ships wherever they might be, so far as strategy was concerned, but probably political considerations had weight in this connection, as the author suggests. In regard to the efficiency of "the fleet in being," it may here be said that Admiral Colomb holds "that whatever the restraining power of 'a fleet in being' might be, when fleets moved according to the wind, it would be enormously increased by the employment of steam propulsion."

The author of the paper condemns "the sort of panic" that reigned all along the Atlantic coast of the United States, because Admiral Cervera was at sea, and no one knew where nor when he was likely to turn up. He says:

"I wonder how much money was wasted in preparing by means of fortifications and submarine mines to meet—not to prevent—attacks that were least likely of all the possibilities of war. We have heard of the inconveniences suffered from the presence of submarine mines in the American ports, but we have yet to hear of the little annual bill which will for years be presented for the scheme of local defense of the American coasts, which it seems is certain to be adopted. . . . As long as we look at things from the side of the defenders, it seems the most reasonable thing in the world to close the harbor of New York by submarine

mines, batteries, and what not in war time, lest an enemy's squadron should come inside and bombard the city. . . . Naval commanders will run into considerable dangers in order to get at ships. But towns are not their business. If towns are to be attacked there will be a landed army and all things regular. No naval officer with his hands free would, in war, proceed into New York harbor in order to damage New York—even if he believed there were no batteries and no mines to prevent him."

Of course the views of Admiral Colomb, and those who think with him, as to the assured immunity of towns and cities from attack by hostile craft, are challenged by a large number of authorities; and certainly an influential school amongst Continental strategists hold that a cause may be helped by operations of this nature which they will not scruple to undertake. Even in this short war we find an instance of the value of such a power, when Admiral Dewey silenced the batteries at Manila by a threat of bombarding, not the batteries, but the town, if his ships were molested. If such a concession could be obtained, why not others? Doubtless the ultimate issue of a war could not be determined by occasional bombarding of coast towns and ports, but the experience would be very unpleasant while it lasted.

After all, this question of ship defense or fixed defense is a matter of cost. A ship is better than a fort because of its mobility. Very true; but those who tell us this also tell us we have not ships enough. If we ask "Why?" we learn that it is because ships cost money, and we spend all the taxpayer will find; in short, money is the limiting condition. Now, to bottle up and blockade the fleets of our enemy we need three ships for every two bottled up; and if we take a very possible alliance against us, we find little more than a balance of vessels between ourselves and our opponents. This brings about a condition of a number of unbottled ships of our adversary free to carry out their avowed intention of preying on our commerce or bombarding our defenseless coast towns. Still looking at the matter from an economical point of view, how are these towns best protected? They lie at a distance of every few miles all round the English coast. There may be twenty unbottled cruisers of our enemy, and it might take two, or perhaps three, forts to keep them at a harmless distance from any one town. Each town must have its own fort or forts, and there are more than twenty towns. The question then arises, Would it be cheaper to build thirty more ships to bottle up the enemy's twenty, or to construct forts sufficient for defense of all the towns?

Forts are certainly cheaper than ships, and they cannot be sunk, but then ships can go out and sink other ships, which forts cannot do, therefore the enemy's vessels always remain as a menace, so far as the forts are concerned. Mine fields are of very limited use. They cannot be extended indefinitely, and modern naval guns are effective at long ranges. It is not very likely that an enemy's ship would venture far into inland waters whilst there was a possibility of a superior force catching him in the trap. The bombardment of London, or even Gravesend, would presuppose the loss of the sea to us, and in that case fixed defenses would be of small avail. There is, however, the important consideration of the defense of our oversea commerce, and that needs ships, not forts, although certain defended positions would be desirable for merchant ships to make for at need.

As we have said, the problem is one of finance, and we trust it has been duly worked out by our intelligence departments. It is to be feared,

however, that each branch of the service thinks so exclusively of its own function that no combined effort of this nature has been attempted. This aspect of the question is one of the first importance, a fact that was illustrated during the late war when the Americans, almost unopposed as they were, suffered considerably by the lack of cohesion between the naval and military branches. The respective values of forts and ships should be doubtless settled by compromise. Admiral Colomb himself points out the protection and assistance that forts can afford to ships; and where such cheap auxiliaries to the navy can be made effective, it would be foolish to neglect them. The need of safe havens in which ships can refit, or in which they could take refuge in the face of superior force, are among the foremost teachings of history, but to hope to put it out of the power of hostile vessels to hurt us anywhere simply by fixed defenses is beyond hope. After all, if we go to war, we must take our chance of being hit, and the craving for absolute safety is not one that can be satisfied.

The absence of torpedo operations was a feature in the war that caused a good deal of surprise to many people. The Americans made so much use of the torpedo in their own Civil War—considering, that is, the very imperfect state of its development at the time—and the weapon seemed so fitted for the ingenuity and mechanical audacity of the race, that we fully looked forward to some new and diabolical departures in this field. As a matter of fact, however, the American Navy had nothing very effective in the way of torpedo craft, and the Vesuvius with its dynamite gun, which was to have worked such wonders, proved comparatively a failure, so far, at least, as rendering efficient aid to the fleet was concerned. The Spaniards, on the other hand, possessed some fast and well-equipped vessels; but these, like the rest of the Spanish fleet, had been allowed to fall into such a deplorable state that probably little could have been expected from them had they had the chance of operating.

Admiral Colomb refers to the danger from conflagration resulting from shell-fire. Since the battle of Yalu this lesson has needed no enforcing for those who will take the trouble to read plain facts. Admiral Colomb agrees with the late Admiral Sir Cooper Key, who, thirty-three years ago, said that the danger from fire, through the bursting of shells, even in wooden ships, was not great. It was not that fires would not be started, but with well-disciplined crews they would be taken in time and easily subdued. It is the case over again of "the carpenter's cap being the best fire extinguisher in a theater," and Admiral Colomb rightly says it is a question of men rather than materials. Still it is wise to reduce combustibles on a warship to the lowest limit, either by treating wood chemically or by substituting metal for it. This is an important point we shall return to again. The admiral does not approve of the present arrangements for pumping service or fire service in our ships. He has "never reconciled himself to the main drain, nor to the main fire service of pipes," but is more inclined to the isolation of compartments; "feeling that in one case there would in emergencies be an unexpected flooding of compartments supposed to be cut off, and in the other a breach of continuity in the water-pipes." When he had to consider the matter formerly, however, he could see no alternative, but now he is of opinion that "the dynamo, the motor, and numerous alternative electrical communications offer conveniences for isolating compartments as to pumping and flooding service."

There is one other point that we will mention before closing our notice of Admiral Colomb's valuable paper; a contribution which will be printed in full in the *Journal of the Royal United Service Institution*, where all interested in these matters should refer to it, as we only touch on some of the most salient features. The remaining point is the effect of gun-fire on the thickness and disposition of armor, the question arising in connection with the risk of conflagration through shell-fire. A theory largely held was, and doubtless is, that no armor was better than thin armor, as shells would go through unprotected sides and thus right through the ship without bursting, but if there were even thin armor, the resistance would be sufficient to cause the shell to explode. This resulted in a small area of very thick armor and a very large area quite unprotected. In reference to this Admiral Colomb says that:

"Experiments undoubtedly showed that projectiles which penetrated armor, especially if they broke up, created much greater interior havoc than such as passed clean through thin plating intact. Hence the argument was, that there should be no armor except such as would stop everything, and that otherwise everything should be allowed to go through. The logic was sound enough if it could be guaranteed that the enemy would only fire heavy projectiles. But as the policy left 3-pounders effective, it was inevitable that they would be effectively used. To me the real point was a balance between the gun and the armor. If the balance were to be drawn at 3-pounders it was still a balance, so that the loss due to letting 6-pounders through was compensated by the gain of keeping 3-pounders out; or if the balance were to be drawn at 6-pounders, then the loss due to letting 12-pounders through was compensated by the gain of keeping 3-pounders and 6-pounders out, and so on."

The reasoning here is quite sound in principle, the difficulty of course lying in balancing the chances. It should, however, be remembered that when the Inflexible was designed—which ship the author refers to as being inferior in her system of armor to the original La Gloire, and also to the Achilles and Minotaur—the principal armament was almost the only armament, and it is the wonderful growth in the efficiency of secondary armaments which has caused designers very logically—and often very courageously—to alter their plans and adopt a system that may have been premature at the time it was first suggested. The earlier ships manned had to be armored to meet what was practically wholly a secondary armament, and now that secondary armament is once more to be in the ascendant, we have a return to the older conditions.—*Engineering.*

THE SPANISH-AMERICAN WAR.

A mass of official correspondence relating to the late Spanish-American War has recently been published by the United States Government. It consists chiefly of letters or dispatches that passed between the Government and the naval officers on the scene of action, and is contained in a bulky volume published as an "Appendix to the Report of the Chief of the Bureau of Navigation" for 1898.

The British citizen, into whose hands this volume may fall, versed only in the ways of our own secretive government, will be astonished at seeing so many things that we consider almost sacred, and for official eyes alone, published abroad so that all the world can read. When our

natural prudery becomes a little blunted by custom, as it must in going through the volume, we ask ourselves, "What harm is done by this openness of speech?" and the answer appears to be, "Very little; and what there is is far more than balanced by the good." It is well the public, who pay the bill, should know (after the event, when no sinister result will follow through the enemy also gaining knowledge) how well or ill the servants of the state have done their duty. With the higher permanent officials of the government departments there is often no other means of punishment for neglect or incompetence than public censure; but want of knowledge blunts this weapon. There is a great deal too much of the spirit of trades-unionism in the Civil Service for the sins of omission or commission to be brought home to individuals. It is always the fault of the system, or, at worst, the department. Now, although we are very far from saying that they manage public affairs better in the United States than we do in England, yet in the publication in question very concise particulars are given, so that if there had been failure on account of unpreparedness, the American public would have known pretty well where to put the blame. Had there been the assurance of such a publication as this hanging over the heads of our own military departments, certain untoward events in our own history, due to forgetfulness, or worse, and which resulted in loss of life and treasure, would hardly have occurred, because there would have been the fear that an indignant public would have demanded swift punishment. As it is, only those concerned know that some neglected their duties; but no one is punished.

Other publications have also been issude by the Office of Naval Intelligence from abroad, by the secretary of the United States Navy, and by the engineer-in-chief. From these various sources a great deal of information as to the strategy and political aspect of events may be gleaned. With these features, however interesting they may be, we cannot hope to deal, as being somewhat beyond our scope and certainly outside the limits of our space. There are, however, certain matters bearing on naval matériel, etc., which may be with advantage put on record in our pages.

One of the most interesting features in the report of the chief of the Bureau of Navigation consists of reproductions of a series of photographs of the disabled Spanish ships. These show in a very impressive way how destructive is the fire of the modern artillery when properly handled. The first series of these photographs illustrate some of the ships that were destroyed at Manila. It will be remembered that on May 1, 1898, the United States squadron, under Commodore—afterwards promoted to the rank of Rear-Admiral—George Dewey, consisting of the U. S. S. Olympia (flagship), Baltimore, Raleigh, Petrel, Concord, and Boston, attacked the Reina Cristina, Castilla, Don Antonio de Ulloa, Don Juan de Austria, Isla de Luzon, Isla de Cuba, General Lozo, Marquis del Duaro, El Curreo, and Velasco. There was also a transport and a water battery at Cavite. It would be a profitless task to compare the respective strengths of the squadrons, even if we had full material to do so, as the Spaniards could make hardly any defense. As a matter of fact, at Manila, as elsewhere, the Spanish ships were not in a condition to fight. Many of them might almost as well have been merchant vessels.

Two mines were exploded ahead of the Olympia as she steamed into the bay, but too far off to do any damage, and the opportunity of defense by fixed engines was almost neglected. The American squadron maintained a continuous fire at ranges varying from 2000 to 5000 yards.

The Spanish fire is described as "vigorous but generally ineffective." The shore batteries also replied, but the latter description may evidently be also applied to their fire, as the American squadron was "uninjured and only a few men were slightly wounded." In fact the Americans had practically a "walk-over." This does not detract, however, from the credit due to them for the efficiency and readiness of their fleet, or from the courage and determination shown by Admiral Dewey and those under his command in entering the enclosed waters of Manila harbor—which might have been expected to be heavily mined—in order to get at the enemy's ships, and in spite of shore batteries.

Whichever way our political sympathies may turn, we cannot but admire the courage and self-devotion of the officers and men of the Spanish fleet. All that could be done with defective matériel and lack of practice was done by the Spanish sailors. Early in the engagement they put out towards the Olympia with the intention of torpedoing her, and this it will be remembered in broad daylight, with no prospect of being unobserved. Of course, it was a forlorn hope, or rather there was no hope; it was only an effort to make some sort of defense for the honor of the flag. The fire of the American ship soon put the boats out of action. "The Spanish flagship Reina Cristina," to quote from Admiral Dewey's report, "made a desperate attempt to leave the line and come to an engagement at short range, but was received with such galling fire, the entire battery of the Olympia being concentrated upon her, that she was barely able to return to the shelter of the point." The shell-fire of the Americans at this time set the vessel on fire and she burnt until she sank. The American squadron had opened fire at 5.41 A. M., and by 11.16 the entire Spanish squadron was in flames. As a result three Spanish ships were sunk, including the flagship, and eight were burnt, while two tugs and several small launches were captured.

The photographic reproductions referred to are, as stated, interesting; unfortunately more so than instructive, from the fact that very little is to be gathered in detail. The Reina Cristina appears to have had the whole after part of her superstructure destroyed, but whether this was due to projectiles or fire does not appear. The forward part seems to be less injured. One funnel was broken clean off, and is shown lying in almost a horizontal position; the other has a large hole in it. The next photograph shows the Castilla, with her rail just awash, and other vessels are in a similar state. A deck view of the Isla de Luzon does not give indication that the vessel had been in action, otherwise than from the circumstance that the decks are awash; in fact, this ship appears to have received so little damage to her upper works, that, so far as the photographs go, she might have been sunk by collision, if we except a view taken under the poop, where deck-beams are shown bent and plating stripped off. The fact may be taken as evidence of the excellence of the American fire, which was doubtless at the water-line.

The damage done by the Spanish fire was too trivial to need recording at length. Some plates were indented and planks torn up in the American ships, whilst a little damage was done to rigging, etc., but nothing serious enough to be instructive. On the Olympia an ammunition hoist was temporarily out of use on account of the blowing out of a fuse. The following extract may contain some useful lessons:

"The right gun worked well with the electric batteries. Battery of left gun failed to explode the primer after the first shot; also resistance in

dynamo circuit broken. Used percussion primers in this gun with good results after the first shot. The after turret fired 13 shells. Had three misfires with battery of right gun and two with dynamo circuit as fuses blew out. In renewing fuses they were immediately blown out; so shifted to percussion primers with good results. In left gun one shell jammed, after which used half-full and half-reduced charge, which fired it. The smoke gave considerable trouble, and in both turrets the object glass of the telescopic sights became covered with a deposit from the powder, which had to be wiped off frequently. These are, nevertheless, considered good sights for heavy guns; but it is recommended that bar sights be installed for emergencies. The batteries for 5-in. guns found unreliable. Used dynamo circuit with good results. Ammunition poor. Many shells became detached from the cases on loading, and had to be rammed out from the muzzle. Several cases jammed in loading and extracting."

How poor a chance the Spaniards stood may be gathered from the fact that the Castilla was so crazy that she had, before the action, to be stopped up with cement to an extent that made it "impossible to use her engines"; and even then she was only "nearly watertight." The three American cruisers, according to the Spanish Admiral, concentrated their fire upon his flagship, the Cristina. At the beginning of the action one shell exploded in the forecastle and put out of action all the men serving four quick-firing guns, making splinters of the foremast, and thus wounding the helmsman on the bridge. Another shell set fire to the crews' bags; but a far more serious result was the complete destruction of the steering gear by a shell. Yet another shell exploded on the poop and put nine men out of action, while another hit the mizzen mast and brought down the flag, which was immediately replaced. A shell exploded in the officers' cabin, covering the hospital with blood, and killing the wounded who were being treated. Another shell exploded in the ammunition-room astern, filling the quarters with smoke and preventing the working of the hand-steering gear. It was impossible to control the fire, and the Admiral had therefore no choice but to flood the magazine, as the cartridges were beginning to explode. Other shells of smaller caliber did great damage. One disabled thirteen men, another disabled the starboard bow gun, and the ship was on fire both forward and aft. The broadside guns were, however, undamaged, and with these the fight was continued until there were only two men remaining unhurt and available for firing them. The ship thus being out of control and riddled with shot, half the crew, including seven officers, killed or disabled, the Admiral gave orders to sink her before the magazines should explode. This was done, the crew being taken off by the Cuba and the Luzon, two ships which afterwards shared the same fate. Admiral Montojo then rehoisted his flag on the Isla de Cuba, and fought until all his ships were sunk, when he escaped to shore after having been wounded in the leg.

Thus ended the battle of Manila, if battle it can be called, when on one side hardly a man was hurt; the American casualties consisting of four sailors on the Baltimore receiving slight flesh wounds from splinters. However glad one may be, that those who speak our mother-tongue met with so little disaster, one cannot but sympathize with the devoted Spaniards, who preferred death rather than succumb without striking a blow for their navy and their flag.

We have yet to deal with the naval operations in the West Indies, with which Admiral Cervera was most directly concerned, being in chief com-

mand, but it may be interesting if we here turn to the views of the Admiral as expressed before the commencement of hostilities. The Madrid paper *La Epoca*, published last November some articles dealing with this subject, and the revelations did much to enlighten the Spanish people as to the way affairs had been conducted. The articles consisted largely of extracts from letters written previously by the Admiral. In January, 1898, he wrote a letter to a relative in which he referred to another letter written two years previously. This letter he had requested his correspondent to keep as his vindication, if, to quote his words, "we should experience the sad disappointment prepared for us by the stupidity of some, the cupidity of others, and the incapability of all, even of those with the best intentions."

That was written about the beginning of 1896, but in January, 1898, Admiral Cervera found "the relative positions of Spain and the United States grown worse for us, because we are extenuated, absolutely penniless, and they are very rich." The disgraceful state into which the navy had been allowed to fall is vividly described in the following paragraph, which we quote as an example:

"There is the Cataluña, begun more than eight years ago, and her hull is not yet completed. . . . The Maquinista Terrestre y Maritimi supplies the engines of the Alfonso XIII; Cadiz, the Filipinas. If Carlos V is not a dead failure, she is not what she should be; everything has been sacrificed to speed, and she lacks power, and remember the construction is purely Spanish. Only the Vizcaya, Oquendo, and Maria Teresa are good ships of their class, but though constructed at Bilbao, it was by an Englishman. As for the administration and its intricacies, let us not speak of that; its slow procedure is killing us. The Vizcaya carries a 14-centimeter breech-plug, which was declared useless two months ago, and I did not know it until last night, and that because an official inquiry was made. How many cases I might mention! But my purpose is not to accuse, but to explain why we may and must expect disaster. But it is necessary to go to the bitter end, and it would be a crime to say that publicly to-day; I hold my tongue and go forth resignedly to face the trials which God may be pleased to send me. I am sure we will do our duty, for the spirit of the navy is excellent; but I pray God the troubles may be arranged without coming to a conflict, which in any way I believe would be disastrous for us."

The conviction that those under his command would do their duty was fully borne out by the sequel which Admiral Cervera so plainly foresaw.

The simple words by which he expresses his resignation would touch the heart of the hardest adversary, and the noble way in which he fought his imperfect fleet is a thing of which Spain may well feel proud, even in the day of her disaster; whilst his treatment of Lieutenant Hobson, after the sinking of the Merrimac, shows that the Spanish Admiral possessed not only a courageous spirit, but also a chivalrous disposition that could admire bravery in an antagonist, and could treat one with courtesy even though he had just succeeded in placing a formidable obstacle in the way of the Admiral's escape.—*Engineering*.

ELECTRICITY IN WARSHIPS.

In the middle of his presidential address to the members of the Institution of Mechanical Engineers, Sir William White interpolated a remark

of no little significance. Speaking of the various methods employed for working guns on shipboard, and the predilection which there appeared to be in this country for hydraulic gear, he said that in recent vessels the Americans had discarded electrical mechanisms. He offered no comment. Many months ago, writing upon this subject we drew attention to a few of the objections to the use of electricity on fighting ships, and we pointed out in particular that the effect of the violent concussions, both from firing her own guns and being struck by hostile shot, would certainly disarrange many of the more delicate devices on a vessel of war. That was before the fight with Spain, and as we cannot doubt that America is making haste to profit by the lessons she learnt at Santiago and Manila, we may with some safety conclude that the electric fittings on board her ships have not proved of that wonderful value and efficiency which peace maneuvers seemed to promise.

Not long ago Lieut. B. T. Walling, of the United States Navy, delivered a series of lectures on "The Diseases of Electrical Installations in the Navy," before the United States Naval War College. They may be found printed in the June and December numbers of the last volume of the "Proceedings" of the United States Naval Institute, and will well repay reading, both by engineers and electricians. Lieutenant Walling probably gave these lectures before the war with Spain had taken place, certainly before the experience which had been gained in the naval actions had been fully digested. In his introduction he speaks with enthusiasm of the use of electricity in the navy. "Ever since the introduction of electricity on board ship," he writes, "there has been a constantly increasing demand for this form of energy, and it is to be anticipated that much larger demands are shortly to be made upon the adoption of electrical power, for turning guns as well as turrets, for operating auxiliaries, for all purposes, in short, which will minimize the present objectionable heat of long lines of steam piping, the annoying leaks of hydraulic apparatus, and the excessive weights of pneumatic appliances." This is all the golden lining; on the other side of it there is a cloud, and we need not follow Lieutenant Walling's lecture far before we find that, even apart altogether from its transmission, the generation of electricity on board ship is far from a simple matter. We must, of course, in reading his notes, not forget that it is his intention to call attention to faults and not to virtues. If one were to judge man's health from a knowledge only of pathological dictionaries, he might be forgiven for supposing that there was no such thing as a sound person in the world. But, making full allowances for this, we are still left with the feeling that of all mechanical devices that find place on board ships of war, the one most open to failure is the high-speed electricity supply engine. Under the best possible conditions the high-speed engine is always a more or less delicate apparatus to deal with. It is, so to speak, a vehicle which is always running away down hill. It demands constant attention and watchfulness, for disaster makes haste to overtake it. With an engine running 80, 90, or 120 revolutions a minute one has time to act upon a warning, but when it is a matter of 300 or 400 turns a minute, there is scarcely time to grasp the fact that something is amiss before disaster follows. It is here that the slow, steady, unruffled running of the pumping engines which supply hydraulic power to our gun mechanisms have the advantage over the, may we say, hysterical efforts of the electrical plant. That electricity has, in certain respects, advantages, no one will question for a

moment. It is possible to lead wire in places where tubes could not be conveniently carried, and it is possible to place motors in places unsuited to hydraulic engines. For these reasons the smaller guns on ships can be worked and served by electrical power when the complication of hydraulic supply debars it from competing. Then, too, it is, or could be made, lighter as a whole than hydraulic arrangements, and Lieutenant Walling claims as "the greatest weight in favor of electricity, the ready change from electrical to hand control in emergency, and the facility of maintaining and repairing leads." As regards the repairing of the leads, we admit that it is easier to mend a copper wire than a hydraulic pipe, but that the change from electrical to hand power is easier than from hydraulic we fail to see. If Lieutenant Walling will look into the hydraulic mechanism of any of our recent vessels we venture to think he will find that the change to hand power can be performed with quite as much rapidity as the change from electrical to manual effort on board any of the ships of the United States Navy. Of pneumatic power we do not write; it has never found favor in this country, for reasons which it is quite unnecessary to enumerate. We have no hesitation in saying that it will not long remain in favor with the Americans.

In another place in his address Sir William White used words to the effect that there were still many persons who would like to see greater dependence on manual labor than there is now on our ships of war. Their position is both intelligent and intelligible, and it is only when taken to excess that it becomes ridiculous. In the British Navy, with the exception of the biggest guns, all arms are worked by hand. Every gun of the secondary armament is thus perfectly independent; and though every machine in the bowels of the ship were destroyed, yet a single gun with one man in an unwrecked casemate might prolong the fight. This is an advantage of which Englishmen will always be proud. Moreover, there can be little or no doubt that far more confidence will be felt in action when the guns are worked manually, than when the uneasy feeling is abroad that a chance shot, in a far part of the vessel, may throw a gun out of action at an instant of extreme importance. Could a more terrible event be imagined than when a torpedo-boat was rapidly approaching covered by a group of guns, elevated and trained by electricity, for, just at the critical moment, the leads to be cut by a hostile shot, and the guns rendered motionless, and this too late to make the alteration to hand power and to avert destruction? With large guns the case is, of course, very different. In our recent ships the largest mountings are provided with hydraulic, electrical, and hand power, and these are to be used in the order given. Hand power is unsuited for such heavy work, as even when a large number of men is employed the operations are performed but slowly. In one respect, however, hand power is still found to be quite as satisfactory, if not more so, than either hydraulic or electrical gear, and that is, in the working of the breech mechanisms of heavy guns. There is no necessity here for great speed, because with manual power the gun can be prepared for a new charge quite as soon as the hoists can supply it. Many attempts have been made to devise effective automatic breech gears, and there are some now at work, but, on the whole, it has been found that hand power gives the most satisfaction.

Of other objections to which electrical transmission on board ship is open, and which have influenced our naval constructors against its adoption, we have not space to speak in any detail. The danger of fire from

short circuit, the difficulty of locating a leak or defect, and the fact that the power is supplied by an engine which may suddenly collapse, are among the principal reasons.

But besides the working of guns, hoists, etc., electricity has been used for a number of minor purposes on foreign vessels. It has been, and is still, used for telephones, for range finders, for signalling, and in all navies for lighting, but with the exception of the last it is but little employed in our navy, because it is felt not to be as trustworthy as other methods. This is a fact to which the Americans are at last waking up, and it is evident that the multifarious electrical devices in which they took such pride have not proved in service to be all that could be desired. Even in the matter of lighting, in which there is an accumulated experience to guide us, a useful warning was given in the sudden failure of the supply on board the Burgoyne.—*The Engineer.*

ARMORED SHIPS OF THE FUTURE.

We have been expecting to hear of a distinct change in the application of armor to ships since the Spanish-American war. It does not seem to have taken distinct shape yet; but it must, we think, do so before long. The fact is, that while quick-fire has developed so formidably as to make it desirable to extend armor as far as possible over the hulls of ships, the production of steel plates possessing a high degree of toughness, and at the same time a surface of adamantine hardness, has made it possible to meet this demand. The breakdown of the Spanish Navy has apparently prevented critics from carefully examining certain lessons that are afforded by the events of the war; lessons which, we venture to think, are now sufficiently plain. No incident is more instructive than the behavior and fate of the Cristobal Colon at Santiago. Unfortunately for Spain, when Admiral Cervera made the attempt to break through the American fleet, he elected to push his own ship, the Teresa, to the front, and placed the Colon third in succession, by which means he played his principal game with a ship deficient in quick-fire, and with a hull so totally unprotected, and liable to be set on fire, that her destruction was but the work of minutes; while the Colon, strongly armored nearly all over, and with a powerful battery of quick-fire guns, was so placed that it was probable that she would effect nothing. She ought to have led the way, closed with the Brooklyn, and poured in her quick-fire at such a range as would have secured hitting and not missing. This was in all respects feasible. The Spanish gunners shot badly enough; but we are discussing the powers of ships, and to plead that certain gunners were bad is to drag a herring across the true scent. As a matter of fact, moreover, the Spaniards must have stood to their guns at all events, for the number of hits on funnels, turrets, and masts shows that a great volume of fire, directed too high, passed over the Brooklyn. The latter has a hull better protected from catching fire, but exposed to destruction by langrage nearly as fully as those of the Spanish cruisers which suffered so much. On the other hand, only her principal guns could perforate the Colon's armor, even directly; and it is not likely that more than a little dead metal would have entered her hull, except at the extreme ends. Her 5-in. guns would have broken their projectiles harmlessly on the Colon's armor, as is actually recorded in the one 5-in. hit noted on the accessible part of her

hull. The captain of the Colon, in the order adopted, was very likely not to make trial of her powers, seeing that immediately in front of him was the Vizcaya exchanging quick-fire with the Brooklyn, and it happens that these two vessels were formidable in quick-fire, while, curiously enough, both had smoke-giving powder. It could hardly be recommended that the Colon, unless it had been distinctly pre-arranged, should thrust herself in between them. So it came that, passing on the shore side of her leaders, she ran her inglorious course, receiving only enough shot to remind us how completely her armor protected her, surrendering without injury, and without probably having inflicted any injury worth mentioning on the American ships. It is easy to conceive that the Colon's powers may have escaped recognition, because she was deficient in her principal guns. So cruelly crippled did she appear with her barbettes empty, that her power may easily have escaped estimation. As a lady flippantly put it, "In this condition was she not rather a semi-Colon than a full Colon?" Certainly; but we are considering her in her "semi-Colon" condition, and deliberately say that for the task in hand we could name very few better ships in the world. She needed speed protection, and power of delivering fire powerfully for a few minutes. Speed she had, for she got away at first, making a spurt which left the American ships five miles behind. Protection—she had sufficient to deflect harmlessly the projectiles that struck her; and that her energy of fire was good is easily calculated. Had she actually crippled the Brooklyn, and escaped with only a tolerable and reasonable amount of injury, as we think she ought to have done, the authorities of all nations of the world would have ordered vessels of her type before this. As it is, we think it is only a matter of time before this happens, and for this reason we would call attention to her class. That class consists of six ships; two Italian cruisers, the Guiseppe Garibaldi and Varese; two cruisers built in Italy and sold to Argentina, the Garibaldi and San Martin; and two built in Italy for Spain, the Colon and Pedro d'Aragon. Each ship has a displacement of 6840 tons; each is covered from bow to stern with a water-line belt of 6-in. steel made at Terni, practically on the Harvey system. The same armor both as to kind and thickness covers the barbettes, and is carried over the whole of the central portion of the hull, from barbette to barbette. Astern the armor beyond the barbette is carried to the level of the quick-fire battery deck, thus leaving only a small portion fore and aft unprotected. This 6-in. Harveyed armor is a complete match under service conditions for 6-in. quick-fire guns; in fact, the vessel has little to fear from shell fire. The armament is in each case as follows: Two 10-in. guns, ten 6-in. quick-fire, six 4.7-in. quick-fire, ten 2.2-in. quick-fire, and ten 1.4-in. quick-fire. The speed is 20 knots.

Surely, the powers thus secured for a vessel of only 6840 tons may be regarded as an indication of what new possibilities are opened by the introduction of hard-faced steel armor. The type is certainly open to objection in some respects. For example, the coal capacity is small—600 tons is, we think, too little. Nevertheless, there is evidently the possibility of adopting the main principle illustrated by this type, that is, the recognition of the disproportionate protection given to belts and upper structure, and the grasp of the fact that 6-in. Krupp plate affords very fair protection to the water-line, and its adoption opens the possibility of covering nearly the entire hull with it, or something approaching it. To

lay down anything in detail would require the staff of a construction department, but what is obvious to "the man in the street," if he has his attention directed to it, is that we have before us a class with a displacement of only 6840 tons, with high speed, and with a hull covered nearly completely with armor far thicker than the quick-fire batteries of French men-of-war, which are only from three to four inches of ordinary steel; thicker than those of the Russian men-of-war, which have for the most part five inches of armor; thicker than the armor above the belt of our own Hood, Barfleur, Centurion, and Royal Sovereign class; and equal to that employed in the casemates of our strongest and heaviest battleships; and this may be done mainly by contenting ourselves with the same thickness of belt as has been adopted for the vertical belt protection of the Canopus battleship class.—*The Engineer.*

WAVE ACTION IN GUNS.

By Frederick H. McGahie.

The regularity of action of smokeless powders has been made the question of the day in American ordnance circles by the destruction of a rifle during proof at Sandy Hook. The matter is now receiving a thorough examination by an investigating board, and all knowledge derived from past experience and theoretical investigation will be brought to bear upon this most important phase of propellants, for it is manifestly clear that the value of higher ballistics is negatived entirely if the powder or system employed is accompanied by a decrease in the safety given as compared with the one to be superseded. The facts of the explosion are these: A new 10-inch rifle was being proved by Dupont smokeless powder made in accordance with the Schüpphaus-Maxim patents. Other rifles of the same caliber and type had been successfully tested in the same manner, and the powder has acted normally. The powder consisted of short grains with seven longitudinal perforations, the formula being the standard army one of 75 per cent. nitrocellulose and 25 per cent. nitroglycerin. In the gun in question a charge of 141 pounds had been fired, giving a pressure of 32,000 pounds. This charge was increased a few pounds to obtain the service pressure of 35,000 pounds, the increase being calculated by the Sarrau formula, which has been used most satisfactorily the world over for many years. Disaster followed the command to fire. The breech-block was blown off with velocity sufficient to make it penetrate the protecting butt directly in the rear of the gun and to kill the recorder of tests. The breech-tube was knocked off. As to the condition of the powder chamber and the rest of the gun, nothing can be known definitely until the report of the investigating board appears. A recovered gage indicated a pressure of 70,000 pounds. These conditions show plainly that detonation did not occur, this explosive action being characterized by enormous pressures developed so suddenly that lines of least resistance are utterly ignored in the destructive effects accompanying it. Had the charge of smokeless powder detonated, the whole chamber would have been subjected to an impulsive blow, around 100 tons per square inch, that would have torn it off completely from the tube of the gun and projected it in various sized pieces over the proving grounds. I doubt if a bona-fide case of detonation of a gunpowder charge has ever been clearly established. It serves as an explanation of unknown or un-

established causes. Had the powder cracked up through excessive internal pressure, the sudden increase of burning surface provided by the fragments would have given rise to a dangerous jump in the pressure, which, reacting on the velocity of combustion of the powder, would have carried it still higher before the movement of the projectile had sufficiently increased the expansion volume. Too long a multiperforated or tubular grain will break up into a few, not many, pieces. But the short grains used were far within the limit, and many tons of such powder have been fired since 1894 without giving the slightest hint of such action.

The firings were made in a wide range of guns, with wide variations of loading and ballistic conditions. The accident has been made the subject of several articles in recent numbers of the *Scientific American* and *Scientific American Supplement*.

In the light of the above matter the theories advanced by Hiram S. Maxim appear absurd, if indeed the replies of Hudson Maxim do not reveal the nature of those letters as a vicious attack upon an excellent powder, based upon personal animosities.

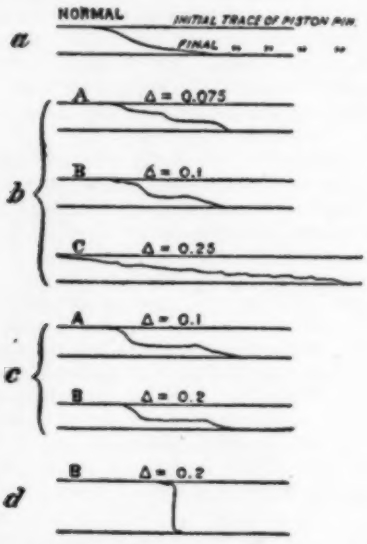
The phenomenon that took place in the wrecked gun was undoubtedly that conforming in general to the theory advanced by Hudson Maxim in his letter in the *Scientific American* of May 13, 1899. Conditions of loading and ignition, of which no data are at hand at present, originated a wave action in place of the normal distribution of pressure. This surging of the gases moved forward along the axis of the bore with great velocity. Meeting the base of the moving projectile, it was reflected back and impinged upon the mushroom head, which would result in compressing the gaseous column, running up the pressure around the burning charge, and accelerating abnormally the rate of emission of gases. This action itself would tend to abnormal pressures, but especially upon the rapid movement of a considerable weight of powder gases being arrested by the breech, the dynamic movement was translated into an impulsive blow in an axial direction that exceeded the endurance of the breech system. In some features it bore a resemblance to a water hammer.

When the late Capt. Sidney E. Stuart was detailed by the Chief of Ordnance of the United States Army to take full charge of the development and manufacture of service powders, brown prismatic was in use and abnormal pressures were observed every now and then in proving the various lots. A few illustrations are given from the firing records:

GUN.	CHARGE. Pounds.	VELOCITY. Foot Seconds.	PRESSURE. Pounds.	REMARKS.
12-inch.....	400	1932	36000	Normal
	406	2006	60000	
12-inch.....	342	1734	33000	Normal
	350	1804	65000	
10-inch.....	200	1813	37600	Normal
	200	1843	59000	

In the above firings the increase of velocities with increase of charge and variation of velocities with equal charges were those normal to single tests of brown powder. The changes in pressure were enormous. In the first group the pressure with 406 pounds should have been in the neighborhood of 37,000 pounds in place of the recorded 60,000 pounds, it being remembered that the gages are screwed into the mushroom head, and

their axes are parallel to the axis of the bore. Neither an examination of the lot of powder from which the charges were taken nor an inspection of the factory records of the lot gave any facts to which the pressure variations could be pinned. M. Vieille, one of the group of French explosive engineers who have published in the Mémorial des Poudres et Saltpètres some of the most valuable studies of explosives at our command, had investigated the action of powder gases in long closed tubes in connection with abnormalities found in French practice. He proved the existence of this wave action, and Capt. Stuart applied the theory to American practice with great success.



It will be well to examine this work of M. Vieille. The apparatus consisted of "a steel tube about 40 inches long and 2.4 inches in exterior diameter, the clear interior dimensions being about 35 inches and ⅞ inch respectively. The ends of this tube were threaded and received exactly similar crusher gages, the pistons of which carried pins external to the tube and projecting perpendicularly to it, designed to record the motions of the pistons. Ignition was obtained by an electric fuse carried by a screw plug entering from the side near one end. Obturation was secured by seating the plugs in copper rings. The tube was fastened in a horizontal fashion on a metallic table in the firmest manner possible. A strong axle placed near and parallel to the tube carried at each end a metal cylinder with a blackened surface, so placed as to receive the trace of the pen carried by the piston of the corresponding crusher gage. This axle was rotated by an electric motor by means of a pulley attached midway of its length, in order to avoid differences in the torsion of the axle between the pulley and the two cylinders. The scale of time was obtained by a tuning fork making 500 vibrations per second, which were sustained by an electro-magnet. Various refinements in the character and manner of this portion of the apparatus secured a rigorously exact scale of time,

and the whole apparatus operated in a manner insuring a high degree of accuracy in its indications."

Three kinds of powder were used in the experiments, (*A*) musket, (*B*) siege gun, (*C*) large rifle. The conditions of loading were varied in three ways, the charge being distributed uniformly throughout the length of the tube, collected at one end, or collected similarly in equal parts at each end.

While the pressure was developing during an experiment, the piston of the crusher gage would move forward in reducing the height of the copper plug, and the pin carried by it would trace a curve upon the revolving cylinder, the tuning fork meanwhile establishing a time scale. As the weight of the piston was designedly light in accordance with the theory of crusher gages, the deformation of the copper plug would keep pace with the increase of pressures, and would register any momentary excess of pressure due to the compression of the head of a surging gaseous column, arrested at the end where the crusher gage was. M. Vieille put the rectified curves into four classes, typical case being illustrated in Fig. 1. Of these, *a* is the case in which the copper plug was compressed regularly to a normal value, *b* in which the deformation rose to a normal value by steps, *c* in which an abnormal deformation was produced by steps, and *d* in which an abnormal crushing was attained at once. Selecting illustrative data from the experiments, the following table shows plainly the value of uniform distribution of explosives in long tubes.

Powder.	Density of Loading.	Indicated Pressure, Pounds per Sq. Inch.	Class of Trace.	Conditions of Loading.
A	0.075	10,000	a	Uniform distribution.
	0.075	10,900	b	Collected at firing end.
	0.075	9,800 / 10,350	b	" " " "
	0.1	15,800	a	Uniform distribution.
	0.1	23,950	c	Collected at firing end.
	0.1	20,400	c	" " " "
	0.1	21,850	c	" " both ends.
	0.1	24,850	c	" " " "
	0.1	24,500 / 25,400	c	" " one end.
	0.2	34,500	a	Uniformly distributed.
	0.2	107,000	d	Collected at firing end.
B	0.2	29,500	a	Uniform distribution.
	0.2	66,600	d	Collected at firing end.
	0.2	51,300 / 49,300	c	" " " "
C	0.2	29,300 / 26,500	b	" " " "
	0.25	30,200 / 30,300	b	Results normal with uniform distribution in previous tests.

Double pressures mean readings from both gages.
Single readings from gage opposite firing end.

Previous experiments in much shorter éprouvettes (2 to 6 inches in length and 1 to 2.5 inches in diameter) had disclosed no difference in pressures with uniform and ununiform dispositions of explosives varying widely in their quickness. The tests in the long éprouvette revealed

another state of affairs, as indicated in the above table. Up to a certain low limit of density of loading, increasing with the slowness of the powder, variations in the placing of the charge made little or no change in pressures. Above these limits the collecting of the charge at one end, or of equal parts at both ends, caused deformation of the copper plugs much in excess of that given by the case of uniform distribution at the same density of loading. This occurred with powders *A* and *B*. It would have taken place with *C* if the strength of the apparatus had permitted a higher density of loading. Referring to the pressure curves, all cases of uniform disposition were included in type *a*, showing that the pressure was developed regularly. Below the density of loading limit ununiform conditions gave curves of type *b*, in which the pressure rose to a normal value by successive steps. Above that limit ununiform distribution produced generally curves of type *c*, showing a development of abnormal pressure by several steps, and occasionally of type *a*, representing abnormal pressure in one step. A study of a large number of experiments of this nature led M. Vieille to the conclusion that " for densities of loading above the limiting values the crusher-gage coppers suffer excessive deformations, which demonstrate the existence of real excessive pressures, due to condensations resulting from the arrest at the ends of the chamber of the gaseous mass in rapid motion.

M. Vieille went further into the nature of this wave action, and experimented with the éprouvette suspended freely, and with crusher-gages whose pistons were too heavy to respond to the momentary pressures due to condensation at the end of the tube of the moving gaseous column. A careful review of the matter led him to formulate the opinion that wave action was possible in large rifles when certain conditions coincided. The influence of ununiform distributon of the charge above certain densities of loading depending upon the quickness of the powder has been noticed. The universal practice in ordnance matters is to employ high densities of loading, much above these limits. The influence of length of powder chamber has been indicated by the difference in results obtained in short and long éprouvettes. This refers to the absolute length, and not to relative length in comparison with the diameter. The prevalent custom of igniting the charge is by means of a primer placed in the breech block, whose explosion, acting on the priming charge, would tend to set up some motion in an axial direction and contribute to pressure irregularity. This is borne out by some firings made in 1891 at Sandy Hook in two 3.2 field guns similar in all respects except that one had a radial vent for ignition of the charge, while the other had an axial vent. Loading conditions were the same, and black moulded powder used in these firings.

CHARGE.	PRESSURE.	
	Axial Vent.	Radial Vent.
3 pounds 5 ounces	36,080	32,500
3 " 6 "	37,600	32,450
3 " 7 "	41,300	33,600
3 " 7 "	38,400	34,000
3 " 8 "	39,500	34,350

It will be seen at once that axial ignition gave rise to higher and more irregular pressures than did radial ignition, confirmed by further tests with black and smokeless powders.

It would appear that wave action may find an origination in these con-

ditions: Length of chamber, high density of loading, end ignition, quickness of powder, and ununiform distribution. The first three of these attend every firing of the large rifles of the day, and it may possibly be that the system of gaseous products of explosion is always on the verge of some degree of wave action that other causes may change, according to their nature, into mere irregularities or large and dangerous jumps in the pressure at the breech of the gun and extending more or less into the chamber.

Capt. Stuart noticed that abnormal pressures occurred with brown powder in the tests at Sandy Hook usually with reduced charges. Full charges were fixed to extend the length of the chamber, but smaller charges were generally reduced in length and not in diameter, providing thereby another favorable condition for wave action. Loading regulations were put into force then at Sandy Hook, designed to secure uniform distribution and regularity of inflammation of the charge. The Chief of Ordnance of the United States Army was able to report a year and a half later: "The occurrence of excessive wave pressure, frequently experienced in the earlier stages of our tests of brown powder, has been practically overcome."

Smokeless powders are at one disadvantage compared with brown prismatic. Any accidental variations in conditions that give rise to an abnormal pressure jump will carry it further with smokeless than with brown powder, for the rate of emission of gases increases more rapidly with the pressure in the former than in the latter. The relation in question is

$$V \propto P^x,$$

in which V is the velocity of combustion of the powder at any pressure P, and x an exponential constant depending upon the powder used. M. Vieille has given these experimental values for x: Brown prismatic powder, 0.45; black powder, 0.55; smokeless powder of 50 per cent. military guncotton and 50 per cent. nitroglycerin, 0.55; smokeless powder of 50 per cent. soluble nitrocellulose and 50 per cent. nitroglycerin, 0.60; and smokeless powder entirely of military guncotton, 0.66. Furthermore, in a gun the action is a multiplying one. Some variation causes an irregular jump in the pressure; this increase makes the powder burn faster and deliver a large amount of gas. This additional increment of pressures increases still further the rate of emission, and so each reacts on the other until the movement of the projectile or the destruction of the gun relieves the pressure. This will indicate the complexity of the smokeless powder question. That article we must have. It involves the drawback just stated. On the other hand, a more uniform product is possible in commercial manufacture. Then, again, in smokeless powders the introduction of nitroglycerin in quantity gives one with a lower rate of emission exponent, manufactured more rapidly and cheaply and having far higher ballistic properties than a guncotton powder. But nitroglycerin means a high degree of erosive action at least, while many contend that it introduces a dangerous mechanical stability into powders and generally lay any trouble with a nitroglycerin powder to its presence. It is indeed a puzzling matter.

To revert to the accident at Sandy Hook, it would seem reasonable that, if the inner jackets of the chamber show no signs of a general dangerous stress, wave action may be safely considered as the cause, coupled possibly with some weakness in the breech system of this particu-

lar rifle. If the chamber exhibits plainly that an excessive pressure existed throughout it, wave action must still have a prominent consideration, but the physical condition of this lot of powder enters into the case. Multiperforated powder can be badly made just as well as any other powder. Commercial methods may sometimes diverge from good practice. In 1897 the United States Navy rejected 835,700 pounds of brown powder in getting 699,847 pounds of satisfactory powder. Badly warped and cracked multiperforated powder would not redound to the credit of the system through the results secured in firings. Shipments of cordite have been rejected on these grounds.

Let us examine multiperforated powder as regards uniformity and regularity, as these bear upon the starting of wave action. The general formula may be varied to produce powders running from a pure guncotton to a 60 per cent. nitroglycerin basis. In addition to the incorporation in the usual mixing machine, the ingredients are further mixed and kneaded thoroughly on rolls. From the press the powder issues in rods having exactly the cross-section imposed by the forming die. Good practice in manufacturing insures that the shrinkage in drying is small and regular, this shrinkage occurring with all powders made with solvents. It is less in multiperforated powder than in other powders, and is distributed through at least three burning thicknesses in place of the one thickness of solid grains. The final dimensions of grains are completely in the control of the manufacturer, and accordingly all working details contribute to a maximum uniformity of powder. Matters still favor it in the gun. The gravimetric density of the grain is greater than with any other shape; that is, a given weight of multiperforated powder of any formula, with a given least dimension, will occupy more volume than the same weight made up into any solid grain with the same least dimension. Under these conditions more multiperforated powder can be used for a given pressure than is possible with the other powders. The natural result is that the chamber is more fully filled by the charge, and the danger of ununiform distribution through accident obviated to that degree. An essential point to regular pressures is regularity of inflammation of the powder by the priming charge. For this condition the multiperforated grain is ideal, since the perforations of the grain and the air spaces between the short cylinders afford an easy path for the igniting gases to penetrate and start simultaneous combustion throughout the entire charge. Laminal and cubical grains are sadly lacking in this respect, and their firing records testify to it. The mechanical integrity and structure of the grain rests here, as in other powders, with the personal equation of the factory. The company that developed the powder in question used the most trying formula, and yet every lot delivered gave a satisfactory account in guns, running from the 6-pounder rapid-fire gun to the 12-inch rifle, exciting comment by its remarkable uniformity and regularity of action. Another word in regard to the Hiram Maximized theory of internal explosion of the grains. Were it true nothing but solid rods are permissible. Yet nobody objected to brown powder with its central hole, or to short tubular smokeless powder. The short grains afford easy passage for the gases of internal combustion in their initial dimensions, and combustion increases the area of the passage as the square of the linear enlargement, while the burning surface is growing only in direct ratio. The best testimony of the erroneousness of the theory is given by some grains in the possession of Dr. R. C. Schüpphaus.

After a firing in the 3.2-inch field gun of a somewhat slow multiperforated powder, the pressure being 30,000 pounds, grains were found in the sand in front of the gun burned out perfectly, so that the circular perforations were almost tangent. Though quite fragile, they were perfectly intact. Another sample is an extra slow powder fired in an 8-inch rifle at 15,000 pounds pressure. It is burned up about half and in first-class condition. Again, after a firing in an 8-inch rifle at 35,000 pounds pressure, I picked up many of the curvilinear rods formed by the burning out of powder with circular perforations. Their heights were all uniform, and equal to the original heights less twice the burning thickness, as was to be expected from the combustion at both ends. I regret that the absence of Dr. Schüpphaus does not allow photographs of the grains mentioned, but the *Scientific American Army Supplement* contains one of the grains partly burned at 5000 pounds pressure.—*Scientific American*, May 27, 1899.

THE NAVY ESTIMATES.

The explanatory statement by the First Lord of the Admiralty on the Navy Estimates for 1899-1900 was issued the end of last week as a Parliamentary paper. Mr. Goschen commences by saying that the estimates for the coming year amount to a net total of £26,594,500, as compared with the sum of £23,778,400 voted for the year 1898-1899—showing an increase of £2,816,100. Of this increase the votes connected with the personnel account for £452,600—including an increase of £55,300 in the non-effective votes—which will amount to £1,890,700. Various miscellaneous votes show an increase of £40,900. The works vote is higher by £145,000. The ordnance vote is higher by £161,600. The shipbuilding vote shows an increase of £2,016,000. The liabilities included in this vote due to the supplemental programme of last August amount to two millions.

The total number of officers, seamen, and boys, coastguard, and Royal Marines voted for last year was 106,390, an increase on the previous year of 6,340. On February 1 the number was 105,280, leaving only 1100 to be entered during February and March. There is no reason to doubt that the total number voted will be reached by the end of the financial year. A force of 110,640 is proposed for 1899, being an increase of 4250. The additions proposed to meet the larger requirements of the fleet are 463 officers, 1700 petty officers and seamen, 215 engine-room artificers and artisans, 1000 stokers, 172 miscellaneous, 500 marines, 200 boys under training.

The increase in the numbers voted during the last few years entail a corresponding increase in the number of men in the gunnery and torpedo schools. Additional accommodation has therefore become necessary at Whale Island, for which provision has been made in the estimates.

On account of expansion it has been necessary to increase flag officers from 68 to 80, captains from 208 to 245, commanders from 304 to 360, lieutenants from 1150 to 1550. These additions will be effected gradually over a certain number of years. The number of engineer officers is to be raised from 950 to 1050, the increase to be spread over two years. Medical officers are to be raised from 450 to 490 gradually, chaplains from 59 to 69, and naval instructors from 50 to 60; chief gunners and chief boatswains to be increased from 80 to 100, gunners and boatswains

from 920 to 1150, chief carpenters from 18 to 20, carpenters from 207 to 240.

During 1898, 2871 recruits were raised for the Royal Marines, of these 572 were drafted to the Artillery branch, and the remainder trained for the Infantry. The waste of the corps for the year amounted to 138, including men who were transferred to serve as stokers, ship police, artificers, and in other ratings at their request. It has been decided to increase the net pay of the Marine on shore by 2d. a day. The deduction of 7d. now made for rations and groceries from his pay of 1s. 2d. will be reduced to 4d., while, on the other hand, the penny a day for beer money will be abolished. His net pay on shore will accordingly in future be tenpence in place of eightpence. The average number of non-commissioned officers and men on shore during 1898 was 7079. Of this number over 6000 were put through the annual course of musketry training.

The total number of executive officers of the Royal Naval Reserve now on the active list who have served for twelve months or more in the navy, or who are now undergoing twelve months' training, is 243, an increase of eighteen since last year, notwithstanding that 35 of these officers have been appointed supplementary lieutenants and sub-lieutenants in the Royal Navy. In the estimates for last year provision was made for increasing the executive officers' list by 100. The additional officers have all been appointed, and there are now no vacancies, while 175 candidates are on the list of applicants for appointments. By order in council of May 19 last an increase of 100 in the engineer officers' list was sanctioned, raising it to 400 officers. In all 351 officers are now borne, and it is anticipated that the list will be complete in a year at the present rate of volunteering. During the year ended December 31 last 1711 seamen were embarked for six months' training in Her Majesty's ships. On that day 810 of these men were so serving. It is expected that 1800 men will have been embarking during the financial year ending March 31, 1899, an excess of 600 men over the number estimated. Provision has now been made in the estimates for the embarkation of 2000 men.

All the vessels proposed to be commenced during the financial year under the original programme 1898-99 have been begun. Of the vessels included under the supplemental programme the four battleships and two of the cruisers have been ordered, and tenders for the remaining two cruisers have been invited. Tenders for the 12 destroyers have been received, and are now being considered. It was not possible to complete these arrangements at an earlier date, having regard to the preparation of the necessary designs and specifications, and to the large amount of current work on new construction. The expenditure and progress on ships building have been greatly influenced by the unprecedented activity in mercantile shipbuilding, which has followed the settlement of the labor difficulties that so seriously affected the work of last year. The disarrangement of work arising from those difficulties has produced a sensible effect on the completion of ships in 1898-99, the most serious result being the great delay experienced in the supply of steel and other materials required by private firms to whom Admiralty orders have been given. This has been especially felt in the case of ships commenced in private yards in 1898-99. The dates of laying down the ships were consequently later, and the sums earned on these vessels had fallen below what would have

been earned under ordinary conditions. The manufacture of armor has been affected by the fact that the introduction of a new and superior quality has necessitated the reconstruction of plant, and involved many difficulties only to be overcome by experience. The output has been greater during the current year, as compared with 1897-98, but the anticipation of the Admiralty that there would still be a temporary limitation of the supply has proved to be correct. All the neighboring firms have been kept full of orders, and urged to increased production, but the earnings for the present financial year will fall considerably below the sum provided in the estimates. It is hoped that in the coming financial year 1899-1900, a larger output of armor will be available on contract work generally, including armor, hulls, machinery, gunmountings, etc. The various hindrances above mentioned will cause the aggregate earnings to fall short by about £800,000 of the estimated amount on ships previously ordered, which were in stages of construction less affected by the peculiar conditions of the year. Excellent progress has been made, and in some cases the amounts earned have exceeded expectations.

Extra expenditure on labor and ordinary materials for new construction and on repairs in the dockyards will to the extent of about £360,000 absorb the short earnings on armor and other contract work.

The battleships Hannibal and Illustrious (Majestic class), which were practically ready for service at the end of the last financial year, were commissioned soon afterwards. Of the Canopus class two (the Canopus and the Ocean) will be completed and ready for trials about June next. The Goliath will follow three months later, and the Albion and Glory will, it is anticipated, be delivered by the contractors in time for completion before the close of the financial year 1899-1900. The last vessel of the class—Vengeance—is being rapidly advanced, and, according to the contract, will be delivered in July, 1900. Of the Formidable class two—the Formidable and Irresistible—were launched before the end of 1898, and the Implacable is to be launched this month. In this case the rate of advancement has exceeded expectation. The four battleships recently ordered under the supplemental programme are intermediate in size between the Formidable and Canopus classes, and have practically the same armament as the Formidable, but are to have superior speed and thinner armor. They are to be known as the Duncan class.

Of eight vessels belonging to the Diadem class, which were in hand at the beginning of 1898-99 two (the Diadem and Niobe) are in commission. The Europe has been for some time complete. In the Fleet Reserve the Andromeda and the Argonaut have completed their trials and will be ready for service by the end of the present financial year. The Ariadne has finished her steam trials and will be completed at an early date. The Amphitrite has been delivered by the contractors and her trials will shortly take place. The Spartiate is being advanced at Pembroke. All these vessels will be ready for service in 1899-1900. Six armored cruisers of the Cressy class are building by contract. Two of these have been ordered in 1898-99 as part of the new programme of four armored cruisers included with the estimates of that year.

Two of the three vessels of the Arrogant class in hand at the beginning of 1898-99, namely, the Furious and Vindictive, have been completed, and one of them, the Furious, has been in commission since July last. The third, the Gladiator, will, it is anticipated, be completed this financial year. Three vessels of the improved Talbot class (Hermes), building by

contract, have been well advanced during 1898-99 and will be completed early in the next financial year. The Hermes will be delivered this month.

Of the ten third-class cruisers of the Pelorus type which were in hand on April 1, 1898, the Proserpine, Pactolus, and Pegasus have been completed and are in commission. The Psyche, Pomone, Perseus, and Prometheus will be completed very early in the next financial year. The remaining two vessels will be completed before the end of the year.

Six sloops of the Condor class are in hand. Two of these are to be completed early in the next financial year. The others will be considerably advanced. The four twin-screw gunboats (Dwarf class) building by contract are approaching completion.

The supplementary programme provided for the twelve additional torpedo-boat destroyers. Orders for them will be placed before the end of the present financial year. Of the 42 destroyers, of 26 to 27 knots' speed, two did not complete their trials successfully with locomotive boilers, and water-tube boilers are now being fitted. It is hoped that they will be ready for service during next summer. Of the 50 vessels of 30 knots' speed which have been ordered in previous years, 31 have been tried and delivered, and another has been tried and soon will be delivered. The remaining 18 are well advanced, and some have passed their preliminary trials. Four experimental vessels of still higher speeds have been ordered. Two of these are under trial.

In the coming financial year it is proposed to commence in the dockyards two battleships (design not decided), two armored first-class cruisers 9800 tons, three smaller cruisers (design not decided), and two sloops. By contract it is proposed to build two first-class torpedo-boats to replace others struck off the list. The two sloops to be laid down are to be in their general character similar to the Phœnix and Algerine. They will be propelled by twin screws and be of moderate draught suitable for river service.

The manufacture of guns is proceeding satisfactorily, and the production is keeping pace with the requirements of the fleet. A design of a new and more powerful 12-inch B.L. wire gun has been approved, the first gun has been delivered, and is now under trial. This type of gun will be mounted in the Formidable class of battleships. A new design of 9.2-inch B.L. wire gun has also been approved. The first gun is under manufacture, and not yet completed. It is intended to mount this type of gun in the armored cruisers of the Cressy class and of the Drake class.

The principal new works for which provision is made in the estimates for 1899-1900 are:

At Chatham.—A new building slip and a new foundry. It has been found impossible to reconstruct the old foundry owing to the failure of the foundations.

At Porstmouth.—Extension of No. 5 building slip and the reconstruction of a new smithery.

At Pembroke.—A new smithery.

At Wei-hai-wei.—It is proposed to begin the establishment of a naval depot. Dredging operations have been already commenced.

For hospitals.—A considerably increased expenditure is again required to provide accommodation for the increased numbers borne and to improve the existing buildings. A bill to make provision for the continuation of the works under the Naval Works Act, and for the commencement of certain others, will be submitted to Parliament.—*United Service Gazette.*

ENGLISH AND AMERICAN GUNNERY.

Many complaints have been made lately about the shooting in our navy, and invidious comparisons have been drawn between our gunnery and that of the United States. The question is one demanding attention, because our accuracy of fire might at very short notice become a matter of vital importance, and it would then be too late to make up shortcomings. The subject has an aspect at the present moment which is not altogether free from difficulty. Crudely expressed, the conclusion that appears to loom up is as follows: Our shooting is not up to that of the American Navy. In the fight at Santiago, which is the only action of which we have anything like a record, the American Navy scored something like 3 per cent. of hits out of the total number of rounds fired. If we are to score much less than this the effect of our fire is indeed poor. If, on the other hand, we conclude that skill goes to the winds on actual service, then there is no use conducting annual practice at all. Clearly the question is masked by the difficulties raised by the disappointing results at Santiago. We should observe that we mean disappointing from the point of view of accuracy, for the actual effect of this small percentage of hits was tremendous. The great incendiary effect produced was due to circumstances which were more favorable than would probably be found again. The Spanish cruisers were singularly open to destruction by fire, and their means provided to deal with fire were very inadequate and failed in time of need. The type of ship we are more likely to encounter in the future will be much better protected. If a cruiser, she may be of the type of the Colon, which at Santiago did not suffer any injury worth notice from such projectiles as struck her. Consequently, we may be sure that the American Navy would not contemplate with equanimity the prospect of making only 3 per cent. of hits in future actions. The first point is to account for this result, and to ascertain if there is a really satisfactory way of accounting for it, and we may say at once that we can hardly conceive circumstances where wild firing would be more certainly provoked than those of Santiago. The Americans were tired out by an uneventful watch round the harbor mouth for several weeks. One hot morning, without the slighest warning, the order was given to close and fire on the Spanish cruisers which were moving out. The United States ships were in most cases slower than the Spanish, so their only chance of hitting lay in what could be done instantly. In a quarter of an hour or twenty minutes all the chances for most of the vessels might be over, and the United States ships had drifted out to a distance far beyond that of practical fighting. In about eight minutes firing had begun, but it was at a range of 6000 yards. Nearly every ship fired smoke-giving powder. If men in a state of repose are suddenly told to score all they can in a few minutes at a rapidly-moving enemy, 6000 yards off, concealed in smoke, they themselves moving as fast as possible, what could be expected? Saving ammunition was no object. The wildest attempt made while the range was possible was better than nothing. Could circumstances arise more conducive to wild firing? Further, so much injury was done to the Spanish ships by the burning out of their wood, that a considerable part of the effect of common shell must have disappeared; hence we think that this terribly small percentage of hits may be accounted for, however unsatisfactory it appears. Certainly the conclusion arrived at by the Americans themselves is, not that accuracy is

out of the question, but, on the other hand, that it is to be attained by all means, for the annual practice is to be greatly increased, that is, from six practices to fourteen per annum, at ranges, so we are told by Mr. Wilson in the *Daily Mail*, of from 800 to 3000 yards.

Now to come to the invidious, but perhaps valuable, comparison that has been raised between our own shooting and that of the American Navy. It must be understood that the comparative number of hits made by vessels in annual practice is very deceptive. In the case of our own fleet, we believe that it will be found that ships on the Pacific station year after year obtain better results than those elsewhere, because the conditions under which they fire happen to be more favorable. The American heavy guns fire at a target 56 ft. long, and 16¾ ft. high, which is enormously larger than our target. Without, however, disparaging our own gunners, who probably do very well according to the opportunities afforded them, we cannot fail to conclude that we must be at a great disadvantage if we practice much less than the American Navy, which it appears is the case. Latterly, happily, attention has been awakened to this question. Our admirals are doing what they can to encourage good shooting at their various naval stations, and the Admiralty are increasing the amount to be spent on annual practice. Let us hope that this is only the beginning of better things. At Crete the British ship engaged fired with such success as to present a striking contrast to her foreign consorts; nothing, however, can be built on the results of two or three rounds. It is well to be glad that we appeared to advantage, while, at the same time, taking means that as little as possible shall be left to chance in any future war. Money can hardly be better spent on any purpose connected with war which would yield such fruit as that laid out in perfecting our shooting.—*The Engineer.*

THE SUPERIORITY OF THE BRITISH BATTLESHIP.

If experience at sea under all kinds of weather is to prove a valuable factor in the next great naval war, then the British Navy, writes E. H. Mullen in the course of an article on "The Problem of Battleship Design: A Defense of Sir William H. White, Director of Naval Construction of the British Navy," appearing in the current issue of *Cassier's Magazine*, has the advantage of every other navy in the world. The mere ordinary reliefs of 200 war vessels of all kinds at present in commission, and spread over every quarter of the globe, mean in the aggregate an enormous amount of cruising through calms and storms, or steaming from cold climates to hot and vice versa. Out of this experience has come the prevalent British practice of having all warships good sea boats; and from this there has followed, at first perhaps unconsciously, but now as a carefully studied art, the designing of war vessels to be good gun platforms in fair weather or foul.

An observer who saw the British and French fleets meet in mid-channel in 1895, as escorts to the Tzar of Russia, who was then visiting the principal countries in Europe, says that the British ships were as steady in the choppy sea as if they had been riding in a land-locked harbor, while the French ships danced about so much that many of the officers and men were palpably seasick. Now men who are seasick are almost as much hors de combat as if they were severely wounded.

On the other hand, a warship may be a good sea vessel, and yet, owing

to the low elevation of her guns, may not be able to use them in a storm. Lieutenant E. W. Eberle, U. S. N., has said that the United States battleship Oregon, which proved herself to be an excellent sea boat, could not have fought any of her 13-inch guns during a gale, or for hours afterward, and could have fought her 8-inch guns only at intervals in rough seas. This argument in favor of the high freeboard in the Majestic and Canopus classes is apparently irresistible.

In practice shooting, made to resemble service conditions as nearly as possible, the British Navy attains an average of 30 per cent. of effective hits, but no one expects this average to be maintained during the excitement of an action. If the Olympia had maintained this average at Manila she would have made ninety-six effective hits, or enough to have destroyed the whole Spanish fleet single-handed. It is, therefore, in the opinion of Sir William White and his fighting chiefs at the Admiralty, not so much a matter of the number of guns as the excellence of the shooting with those that are provided. Moreover, with 6-inch quick-firing guns, using 750 pounds of shot and cordite every minute, it becomes a matter of practical difficulty to keep more than a certain number of guns supplied.

It is to Sir William White's credit that amidst all the mechanical complexities of the modern warship, he never lost sight of the fact that without men a warship was merely a costly lump of steel. Quick-fire guns, light and heavy, well dispersed and each with a wide angle of fire; ample protection for gunners and stokers alike, plenty of ammunition, coal and supplies; a good gun platform in rough as well as fine weather—these were the qualities realized by him in the Majestic, and these have made her a favorite type for imitation by naval architects of other nations.—*United Service Gazette.*

COLOR-WEAKNESS AND COLOR-BLINDNESS.

It is generally accepted as a well-established fact that the traveling public is fully protected by the present tests for color-blindness to which railway employees and pilots are subjected. Yet several of the mysterious accidents that have occurred during the last two years might be explained on the supposition of color-blindness on the part of responsible lookouts. In fact, I believe myself in position to prove that persons of dangerously defective color-vision actually do pass the regular tests and obtain positions where their defects are continual dangers to public welfare.

In the first place, I have at the present time among my students one who is absolutely perfect at the wool-test. He can match wools with incredible precision at any distance away; he is, nevertheless, color-blind. This case is typical of a class of persons with eyes abnormally acute for differences in color, but yet with only two fundamental sensations instead of three.

In the second place, I have had among my students those who possessed perfect color-vision for near objects or bright objects, but who were practically color-blind for weakly illuminated or distant objects. These persons possess the typical three fundamental color sensations, but have one of them weaker than the normal. A person of this kind may pass the wool-test with the utmost perfection if the test is performed close by, but will fail if the wools are removed to a distance of 20 or 30 feet. This peculiar defect I take the liberty of terming "color-weakness." The first

student of this kind that I examined passed the wool-test close at hand and yet was unable to distinguish red and green lanterns a few hundred yards away. Cases similar to this have been reported by the British Marine Examiner, Edridge-Green. Among other cases he quotes a letter from an engineer containing the following statement: "I have been on the railway for thirty years and I can tell you the card-tests and wool-tests are not a bit of good. Why, sir, I had a mate that passed them all, but we had to pitch into another train over it. He couldn't tell a red from a green light at night in a bit of a fog."

To eliminate both these classes of persons we must have a method of testing on quite different principles from the usual ones.

In the first place, the sorting of delicate shades of colors, according to likeness, must be replaced by *naming certain fundamental and familiar colors*. The sorting of wools is a quite unusual and perplexing task to a man brought up in a railway yard and on shipboard. It puts a nervous man at quite a disadvantage; it furnishes the unsuccessful candidate with the excuse that the judgment required was so unlike any he had made before that he failed from nervousness; and, finally, it is not a guarantee that all who pass are not color-blind. The naming of colors should —as Donders proposed—be rigidly required. The engineer or the pilot in his daily routine is not called upon to match colors, but to decide whether a light is red, green or white; he should be tested on just this point. The color-blind student referred to above who can pass the wool-test to perfection fails at once when called upon to name the wools. The naming of delicate and perhaps unusual shades should, however, not be required; the colors to be named should be the three familiar ones: red, green and white, so manipulated that every possible chance for confusion is presented.

The second necessity for eliminating danger is that of an absolutely certain test which shall detect both the color-blind and the color-weak. Acting on the basis of suggestions from the work of Donders and of Edridge-Green, I have devised a test that meets this requirement as well as the first one.

The instrument* which I have invented may be termed the "color-sight tester" or the "color-sense tester." In general appearance it resembles an ophthalmoscope. On the side toward the person tested, there are three windows of glass, numbered 1, 2 and 3, respectively. The opposite side of the tester consists of a movable disk carrying twelve glasses of different colors. As this disk is turned by the finger of the operator the various colors appear behind the three windows. At each movement of the disk the subject calls off the colors seen at the windows. The windows, 1, 2 and 3, are, however, fitted with gray glasses. No. 1 carries a very dark smoked glass; all colors seen through it will be dark. No. 2 carries a piece of ground glass, showing all colors in full brightness. No. 3 carries a light smoked glass. There are thus thirty-six possible combinations of the colors. The twelve glasses are, however, mainly reds, greens and grays.

A suitable arrangement of the colors gives direct simultaneous comparisons of reds, greens and grays of different shades. The well-known confusion by color-blind persons of dark greens with reds, greens with gray, etc., are exactly imitated, and the instrument gives a decisive test

* For those interested in obtaining the Color-Sight Tester I will say that I have made arrangements to have it made by the Chicago Laboratory Supply and Scale Co., Chicago.

for color-blindness. Its peculiar advantage, however, lies in the fact that it presents reds, greens and grays simultaneously in a large number of different shades of intensity. The light of a green lantern, at different distances or in a fog, is simulated by the green behind the different grays; at the same time a white light is also changed. The color-weak person to whom weak green is the same as gray (white at a distance) is utterly confused and thinks that the weakened green is gray (white) and the dark gray is green.

The actual test is performed in the following manner: The tester is held toward a window, at about 2½ feet from the person tested. The operator begins with any chance position of the glasses, and asks the person tested to tell the colors seen through the three glasses, Nos. 1, 2 and 3. He answers, for example: "No. 1 is dark red; No. 2 is gray; No. 3 is green." The operator records from the back of the tester the letters indicating what glasses were actually used. If he finds that A, D and G were opposite the glasses Nos. 1, 2 and 3 he records: A 1, dark red; D 2, gray; G 3, green. The disk is then turned to some other position; the colors are again named, and the operator records the names used. For example, the result might be: "No. 1 is dark green; No. 2 is white; No. 3 is red"; and the record would read: G 1, dark green; J 2, white; A 3, red. Still another record might give: J 1, dark gray; A 2, red; D 3, medium gray. Similar records are made for all combinations. Of course, the person tested knows nothing concerning the records made. A comparison with a list of the true colors for each position determines whether the test has been passed or not.

The three records just cited were all obtained from the red glass, A; the gray glass, D; the green glass, G; and the ground glass, J, in combination with the dark gray, No. 1; the ground glass, No. 2, and the medium gray, No. 3. Those familiar with color-blindness will notice that these combinations place side by side the colors most confused.

The records can be taken by any one, and, on the supposition that the record has been honestly obtained and that the instrument has not been tampered with after leaving the central office, the comparison is mechanical. There is none of the skillful manipulation required in the wool-test and none of the uncertainty attaching to its results. The only instruction given to the subject is: "Name the colors"; the results render the decision with mechanical certainty.

One of the testers is in use on one of the English railways, another on the central division of the New York Central Railroad. From the former I have not yet heard, but the examiner on the latter reports that since using the tester he has found men who get through the wool-test, but are caught by the tester. On the other hand, he states that "the men examined say that this test is more like the signals they are used to seeing every day on the road, and is, therefore, fairer than to ask them to pick out a lot of delicately tinted pieces of yarn."

An experience of several years seems to justify the following claims for the color-sense tester:

1. It detects with unerring precision both the color-blind and the color-weak.

2. It is a perfectly fair test for the men concerned and injures no man by requiring an unfamiliar judgment.

3. It requires but a very small fraction of the time used on the wool-test.

4. Its decisions are self-evident and unquestionable.—E. W. SCRIPTURE in *Science*.

THE IMPROVED TURRETS OF THE BATTLESHIP TEXAS.

By ROBERT W. HENDERSON, United States Navy, U. S. S. Texas.

The great naval battle of July 3, off Santiago, which ended in the complete destruction of Admiral Cervera's fleet, has shown in the most realistic manner possible that too great a value cannot be placed upon rapidity of fire and rapid-firing guns on board a man-of-war. The battleship Texas took a very important part in this battle, and the efficiency of her large guns is due chiefly to the improvements on her turrets, instigated by Lieut. F. J. Haeseler.

The Texas is a first-rate battleship of the second class, having a displacement of 6315 tons. She is 309 feet over all, has twin screws, triple expansion engines, and on her trial trip she had an indicated horse-power of 8610, giving a speed of 17.8 knots. Her main battery consists of two 12-inch breech-loading rifles mounted in turrets and six 6-inch B. L. R.'s which are slow fire. The turrets of the Texas and those of the Maine are on the same general plan, the port one on the Texas being forward, the starboard one on the Maine, the turrets being situated in echelon. The Texas turrets and barbettes are of 12-inch face-hardened steel armor, while the ammunition hoists and tubes are protected by 8-inch armor. The turrets, ammunition hoists, and rammers are all worked by hydraulic power, the engines being of the three cylinder Brotherhood type. The power is furnished by four powerful hydraulic pumps, all the machinery being inside the armored redoubt.

When the Texas went into commission, it was impossible to load these 12-inch guns except in two positions, pointed directly ahead or directly abeam, the rammers for these two positions being outside the turrets. When firing in intermediate positions, it was necessary to train the gun off the target to load, picking the target up again after loading. This consumed much time, the interval between two shots from the same gun being at that time about seven minutes.

Lieut. Haeseler advanced the idea of carrying a light but strong telescopic rammer inside, which was to revolve with the turret, thus enabling the gun's crew to load from any position. To accomplish this it was necessary, besides securing a strong rammer that could be easily handled, to change the lead of many of the hydraulic pipes, secure a "change" or "balance pressure" valve, and to devise a means of loading inside the turret. A "balance pressure" valve that could be used as a supply, exhaust, and reversing valve was obtained by a slight modification of a "Sellers" valve, and the hydraulic plant was changed accordingly. Immediately behind the breech of the gun, when level, a strong but light telescopic rammer was balanced on trunnions, which permitted its being raised or lowered into working position by one man.

The next problem was to devise a means of transporting the 12-inch shell, which weighs 850 pounds, from the ammunition hoist outside the turret to the breech of gun, as formerly they were hoisted into a loading position forward of the stationary rammers. A circular track carrying a small traveling car was placed entirely around the turret inside the redoubt and a grooved table was put just inside the turret opening. When a shell was sent up from the ammunition room below, it was whipped by a chain strap and differential pulley into the traveling car,

run around to the turret opening by one man, and shoved into the stationary table.

Inside the turret another ammunition lift was placed, running by hydraulic power, and fixed so that in its upper position the shell table on it was level with the bore of the gun in its loading position. One man pushes the shell into the shell table; the powder, which is in four sections, is placed in stands beside the shell; the car is hoisted; the shell and powder are run home by the rammer, and the car lowered for another charge. A small loading platform, working on hinges and secured by a hook, was placed under the breech of the gun, to allow a man to wipe out the powder chamber after the gun has been fired. An interesting experiment was tried in regard to sighting the turret guns, which would have been very useful in case of accident to the regular sights. The gun is sighted by means of telescopic sights placed in hoods on each side of the breech, the officer in charge being in this hood and sighting gun. Ordinarily, in case this hood were to be demolished by a shot, the gunners would be unable to obtain anything like an accurate aim.

Through an aperture in the turret, near the gun, a small tube was placed which was laid exactly parallel with the bore of the gun. Cross wires were fitted in the ends of this tube for sighting. Near the elevating slide, at the side of the gun, an arc was fixed firmly, graduated in yards, and a pointer attached to the slide pointed out the yards on this arc, the accuracy of the arc having been tested by the regular sights. To aim the gun by this improvised sight, the gun was trained on the target by means of the fixed tube, and the gun was elevated or lowered until the pointer on the slide showed on the arc the number of yards indicated on the range finder. The test shots with these sights gave very accurate results.

This constituted the repairs that were made on the guns in the New York navy yard, and after preliminary drills the Texas went out beyond Cape Henry, at Old Point, to test the work. The result was even more than expected. A mean between the intervals of five shots was one minute and fifty-five seconds, a vast improvement on the old record, while one interval was as low as eighty-five seconds. The Texas returned to Old Point ready for whatever was to come, and her record during the late trouble showed how completely she can be relied upon.

Formerly, for these 12-inch guns, there were but two kinds of shells, common and armor-piercing, as shrapnel are not used in the larger guns. Common shells are rather long, weigh 850 pounds, and carry a bursting charge of about 60 pounds of powder. Armor-piercing shells are the same weight, but are somewhat shorter, carrying no explosive charge. They are made of the hardest steel, with toughened point, intended, as the name indicates, to penetrate armor. The new armor-piercing shells have soft steel caps on the points, supposed to give them a greater penetrating effect. A new shell that has lately come into use, and which did good service during the late war, is known as a "semi" shell. It is a combination of the other two, of the same weight, has a hard steel head designed to penetrate light armor, and carries in addition a bursting charge of about 50 pounds. This shell is especially designed for use against armored cruisers or vessels of light protection, and is very effective. The igniting fuse for this shell is a base fuse, instead of the old nose fuse used in common shells. Common shells are intended to be used against forts, earthworks, and unprotected vessels, and were used almost entirely against the batteries before Santiago.

It could always be told when a shot struck, as a great cloud of dirt, smoke, and débris would rise in the air as a shot exploded. Several times, most notably during the engagement of the Texas and La Socopa battery, the guns of the Spaniards were completely buried by the earth thrown up by these shells, but the Spanish soldiers had discreetly retired to a pit on the opposite side of the hill, smoking in calm safety, to return, when the ships had retired, with mules and workmen, hauling out and remounting their guns.

While armor-piercing shells are meant to be used against protected vessels, the "semi" shells, carrying an explosive charge, were used principally during the battle, July 3. Of these shots there is a record of but two, both of which struck the Infanta Maria Teresa on the port quarter, entering just under the berth deck. A remarkable feature was that the holes made by these two shells were so close together that they lapped each other, giving a convincing proof that "lightning" does strike twice in the same place. These shots entered and exploded in the after torpedo handling room, and the effect, as seen by the writer, was something awful. Stanchions were cut to ribbons, frames wrenched from the side plating, and the deck beams were severely twisted. Everything in this part of the ship was wrecked, and a large jagged hole, about 4 feet square, was made in the starboard side. The effect of some of the 8-inch shots was nearly as great. The one exploding in the forward turret of the Oquendo alone wiped out the entire gun's crew, and put the gun out of commission.

That the large guns of the Texas did most efficient work is shown by the attitude of the Spanish officers, who not only feared the marksmanship of the Texas, but were surprised to hear that she was not one of our best and most formidable ships. A bright tompion in the muzzle of the starboard 12-inch gun shows by the following inscription the service it has seen: "Santiago de Cuba," "Guantanamo," "Maria Teresa," "Vizcaya," "Oquendo," "Cristobal Colon," "Pluton" and "Furor," "Reina Mercedes," "La Socopa."

The crew of the Texas showed their appreciation of his services by presenting Mr. Haeseler with a beautiful gold watch with the following inscription: "Presented to Lieut. F. J. Haeseler by the crew of the Texas, in appreciation of his services in creating the 'Old Hoodoo' into the 'New Hero.'"

Considering the severe tests to which she has been subjected, it is safe to say that when her slow-fire 6-inch guns have been replaced by rapid-fire guns of the same caliber, there will be no more efficient vessel of her size in our entire navy than the battleship Texas.

The shells are brought to the ammunition hoist in a sling, suspended from an overhead track. The cage has two platforms, the upper of which carries the powder, done up in sections, and the lower the shells. The cage is hoisted by hydraulic power, and the ammunition is transferred from it as already described. On the same deck with the magazines are the engines and boilers, and above them is a steel deck, 2 inches in thickness, which protects this portion of the vessel, known as the "vitals," from shell fire. Along the sides, at the water-line, is a belt armor of 12-inch steel, and between the belt and the boiler rooms are the coal bunkers, which add their protection to that of the belt. A shell striking above the belt would have to pass through several feet of coal to reach the interior of the ship; if it struck on the belt, it would have to penetrate 12

inches of Harveyized steel and several inches of wood backing and many feet of coal before it could endanger boilers, engines, or magazines. The water itself effectually prevents the entrance of shell below the water-line.—*Scientific American.*

A PROCESS OF FIREPROOFING WOOD FOR THE WOODWORK OF WARSHIPS.*

By C. J. HEXAMER.

A process for fireproofing the wood of war vessels must possess the following qualifications: (1) The material deposited in the fiber of the wood must render it thoroughly incombustible; (2) moisture or water, whether fresh or salt, must not affect the materials in the wood, in other words, they must be insoluble; (3) the impregnating matter must adhere permanently to the fiber so that it cannot be shaken out by any amount of wear or jarring; (4) glycerin or like hygroscopic substances, used in conjunction with other chemicals to render theater scenery incombustible, must not be used, as they would tend to rot the wood; (5) the entire mass, not the surface only, must be equally well protected by the fire-resisting substance, because in battle the woodwork is broken and shattered, and external applications permeating the wood but a short distance, though valuable in ordinary buildings, would be useless for the former purpose.

Water is not only our cheapest solvent, but also the one universally obtainable, and therefore best suited to be used on a large scale. For this reason I concluded to employ a substance soluble in water in the primary saturating liquid, which, in turn, was to be rendered insoluble by precipitation in the fibers by an aqueous solution of another substance, forming with it an insoluble compound. Such a process, with ideal substances, would possess the additional advantage that the insoluble compound would be precipitated, as infinitesimal particles, into the very fibers of the wood, causing it to remain there permanently. No amount of jarring or vibration could shake it out, for, like a soluble dye-stuff made fast or insoluble by a mordant in textile fabrics, it would last as long as the fibers in which it is imbedded.

Injection into the fibers of the entire mass, and the precipitation there of an insoluble fire-resisting compound is, therefore, the desideratum. The question naturally arises, how can a solution be forced into the innermost recesses of the fibers of thick masses of wood? I knew that the most reliable experimental work regarding the saturation of wood with solutions had been done in connection with various attempts to preserve it against rotting and the teredo or ship worm. Before, therefore, beginning to experiment blindly, I carefully studied what had been done in this direction; examining technical books and journals, Wagner's "Jahrbuecher," the reports of committees, boards of inquiry, state commissions, patent reports and processes in actual use.

As a result of my studies and experiments, I came to the conclusion that the best method for impregnating the entire mass of the wood was to subject it to the following process: In the first place, use only well-seasoned timber, thoroughly air and kiln-dried, and worked approximately into the dimensions needed, or, better still, impregnate, whenever possible, the finished articles. Then place the wood in a strong metal

* Abstracted from a paper read before the Franklin Institute, Nov. 16, 1898.

chamber, specially made for the purpose, capable of withstanding strong pressures, and supplied with a lid that closes it hermetically. The receptacle is surrounded by a steam jacket, so that the temperature in it can be regulated at will. The interior of the chamber must be thoroughly dry before the wood is placed there. Let me caution you against steaming lumber before saturating it, a custom still prevalent in many creosoting works. The laborious tests of Drude have conclusively proved that steaming wood before impregnating it with solutions tends to lessen its absorptive powers, and that, therefore, it should be as dry as possible. The temperature in the receptacle is slowly increased above the boiling point of water, which is maintained until all the moisture in the wood has been expelled and the mass is equally heated throughout. The chamber is then hermetically sealed and the temperature in it is reduced to 60° C., and held there. The air in the receptacle is now extracted as quickly as possible by means of an air pump. The more complete the vacuum the better will be the ultimate results. Few persons have any idea of the amount of air contained in porous substances like wood. After the air in the wood has been removed a solution of water-glass in about three times its volume of water, previously heated to 60° C., is sprayed into the vacuum. This method of injection is used to remove the air in the solution. The solution must not be too dilute, but at the same time not so thick as to refuse to enter the finest tissues of the wood; in other words, it must be of such a consistency that after impregnation it is completely retained in the pores. It is almost needless to add that the final results depend on the completeness with which the moisture, sap and air have been removed from the wood before impregnation.

I will not weary you by recounting the lengthy list of materials employed as a primary impregnating fluid, only to return at last to the one with which I had started—soluble glass, one of the best known of fireproofing materials, which possesses the additional advantage that it is cheap.

I might state here that for ordinary purposes a block of wood can be made fire-resisting by repeatedly soaking it in a water-glass solution, and, when dry, coating it with a mixture of the liquid and cement.

To return to the process, when the wood has become saturated with the solution at normal conditions, hydrostatic pressure of about ten atmospheres is applied, which is kept up for three hours; this drives the liquid through the mass. Numerous experiments made in Germany for the conservation of wood (see Mittheilungen des technologischen Gewerbemuseums, Abtheilung, Holz) have conclusively demonstrated that the "hydrostatic-pressure method" is the only one to be relied upon for forcing solutions to the innermost parts of a log.

The question now becomes what to use to precipitate insoluble silica from the solution of soluble glass, thereby forming an insoluble compound in the fibers? A dilute solution of hydrochloric acid was tried at first, but this affected the wood, and would in practice attack metal receptacles. Gaseous and liquefied carbonic acid were experimented with, also calcium chloride, until finally a solution of ammonium chloride, a very cheap substance, was used with excellent results. This produces in the very fibers of the wood a gelatinous precipitate of silica, most suitable for our purpose; salt, which is readily removed from parts near the surface by soaking in water, tending to preserve the wood in the interior; and ammonia gas, which goes off per se.

To apply this secondary liquid the water-glass solution is drawn from

the receptacle, and the before-described process is repeated with the ammonium chloride solution. In practice it may be found advantageous to use a second receptacle, removing the wood from one to the other. The pressure should be applied gradually in the second treatment, so as not to force out the first solution. After the precipitation has been completed the wood is thrown into a stream of running water to dissolve and wash out the salt near the surface, and is then slowly dried.

It may be of interest to add that, as a secondary result of my experiments—by using stronger solutions than are necessary for fireproofing purposes—I had some beautiful specimens of petrifaction, and Dr. Keller so completely turned a piece of filter paper into stone, that it seemed to be a delicate film of some pure white silicious mineral, and no one could possibly have surmised what the substance originally was. It is, therefore, possible that this process can be utilized in the arts in the future to petrify organic substances.

It will probably be urged that my process is expensive; but in a case like this expense is not a factor. We cannot afford to take the risk of not having everything possible about a man-of-war—or for that matter of any ship—fireproof, when upon that fact may depend a victory or a defeat of our navy. Nor is the expense as great as it at first appears; for the Government should attend to this work itself, and not leave it to contractors. In point of fact, I believe it will be found that the only considerable outlay necessary would be the first cost of the large air-tight receptacles. There are, no doubt, plenty of pumps on hand that could be utilized, the amount of labor required is trifling, the chemicals used are of the cheapest, and the plant can be located in a place where running water costs nothing. I therefore fail to see any possible reason why lives on ship should be endangered by fire in the future.

I beg leave to state, in conclusion, as my humble opinion, that everything on board of a ship can be made fireproof. Some things, of course, must be excluded by necessity, such as food, fuel and ammunition.—*Engineering News.*

THE GATHMANN SHELL TESTED.

The first of the two experiments with the new Gathmann shell took place at Sandy Hook on May 9, in the presence of ordnance officers of the army and navy. The Gathmann shell employs for its bursting charge guncotton in the place of powder, which had not always been satisfactory. Sometimes there is not sufficient gas generated by powder to burst the projectile, and this is particularly true in armor-piercing shells. The great danger from the use of guncotton in shells is premature explosion. The inventor, Mr. Gathmann, believes that his projectile will not explode inside the gun and that it will not explode prematurely on loading it, and that the wet guncotton will only explode by detonation. The chief recommendation of the shell was that it could stand the use of smokeless powder as a propellant. In the experiment an old 15-inch Rodman gun was taken to the beach and a very heavy charge of smokeless powder was placed in it; then a 15-inch Gathmann shell containing 82 pounds of wet guncotton was put in place. The gun was then taken to a hole twenty feet deep which had been dug in the beach and was lowered to the bottom, lying horizontally. An electrical fuse was attached and the bore of the gun filled up with sand and stone to increase the strain of the explosion on

the shell. The officers and interested parties got out of danger and the gun was fired. It was shattered with the force of the explosion, which blew out a cavity in the beach 30 feet deep and 25 feet in diameter.

The work of digging for the shell was very severe, owing to the peculiar nature of the sand. The remnants which were found are satisfactory to Mr. Gathmann and his associates. The guncotton had been driven into the sand with such force that it was almost pulverized and, as it was recovered, seemed to consist of about as much sand as guncotton. The breech end of the gun had been shattered and was found in small pieces for a space of 16 feet. The base part of the bronze shell was also found much broken in the breech end of the gun. It was bright on the inside, and this, when added to the evidence of the unexploded guncotton found in the sand, showed that although the shell itself had been broken by the explosion, and although the detonator undoubtedly exploded, the Gathmann arrangement for protecting the charge of the shell had worked perfectly. The muzzle end of the gun for 5 feet was broken into five pieces longitudinally. A portion of the forward end of the shell was found about 3½ feet from where the muzzle of the gun had been. The official report on the experiment will be looked for with interest.—*Scientific American.*

THE BEST FORM OF WATER-TUBE BOILERS.

Passed Assistant Engineer J. K. Robison, United States Navy, in the course of an article in *Cassier's Magazine*, for May, on "The Best Water-Tube Boiler for the Navy: A War Lesson," observes that the arguments for and against water-tube boilers have been gone over again and again until they are threadbare; but the fact that we must have boilers that are capable of being divided into small units and that are capable of quickly generating steam from a cold boiler, must settle the question. Whatever the faults and virtues of this general type of boiler, it must be used to satisfy the manifest requirements of the service. We find that water-tube boilers must be used on men-of-war, but we also find a great deal concerning the type of water-tube boiler that must be used. An increase in the space on board ship devoted to machinery, above the large amount already so allotted, must be avoided. Inasmuch as the grate surface of the new boilers must be greater for the same power developed at the engines, than that in the type of boilers now used, there would naturally be an increase in the boiler-room space required. This must be avoided; and this can be done only by increasing the ratio of grate surface to floor space occupied above that in cylindrical boilers. This ratio must be a large one, and the larger the better.

Considering the crew a ship is sure to have in time of war, and the fact that frequently the water tenders will be new to the ship, and, possibly, even to the type of boiler used, the boilers must not be complex. The number of attachments must be as small as possible to minimize the work of these busy men. No great efficiency in firing must be required to attain a good efficiency of the boiler. This follows from the fact that the firemen in the navy in time of war are not equal to doing any particularly good firing. The fact that no great efficiency in firing must be expected or required, means that the complete combustion of the fuel must not be attempted in one chamber above the fire. There are sure to be holes in this fire. It will not be the same thickness in one place as in another,

and the coal will not lie evenly over the grate. At some point, then, beyond which an opportunity for the economical extraction of the heat from the furnace gases is afforded, the gases of combustion must be thoroughly mixed and a combustion chamber furnished. The care of the boiler while steaming must not be attended with any great difficulty. The water level must be steady. This requires a large area of cross section of the boiler at the water level, and in general requires a large amount of contained water in the boiler. This amount of water must not, however, be so great as to interfere with the ability of the boiler to furnish steam quickly from a cold condition. The parts of the boiler must be afforded a free expansion to make the quick raising of heavy fires under a cold boiler possible without any danger of causing leaks. For the same reason, a good, free circulation of the water in the boiler must be assured. As it is not possible to entirely keep salt water out of the boilers, they must be capable of use with salt water, and the interior must be accessible for cleaning. It must be possible to remove salt and other scale from the water side of the heating surfaces. The tubes must, therefore, be straight tubes and not of very small diameter.

The above conclusions are direct deductions from actual war experience. They must be satisfied to satisfy real war conditions.—*United Service Gazette.*

LIQUID FUEL.

At a recent meeting of the British Society of Arts Sir Marcus Samuel, who has been engaged for several years in developing the oil fields of Borneo, read a paper on "Liquid Fuel," which contained several points of interest, particularly concerning the use of oil as fuel in steamships. In speaking of the development of the Borneo fields, he stated that the first steamer employed in the business of transporting oil in bulk through the Suez Canal was a vessel of 4000 tons burden of oil, while the largest of those employed now carried 6500 tons; three steamers are in course of construction to carry 9000 tons of oil each, or 3,000,000 gallons. There was an enormous future before this fuel, even if it only depended upon its relative cost compared with coal; but when they came to the collateral advantages it enjoyed, the benefits of using it, as compared with coal, were simply overwhelming. As showing the immunity from danger, he said that, the business having been conducted for now over seven years, not a single accident of any kind had happened, either to a ship while engaged in carrying oil, or to an installation. Dealing with the relative efficiency of oil and coal, the speaker instanced the performance of the boiler of a launch used in Hong Kong. In this repeated and carefully checked tests had shown that, while the consumption of coal was 7 pounds per minute, the consumption of oil was only 2 pounds per minute. The pressure of steam realized by 7 pounds of coal was from 96 pounds to 105 pounds, while that raised by 2 pounds of oil was sustained at 116 to 120 pounds. The speed realized in the launch under coal had never exceeded 9 knots, while under oil a speed of 10¼ knots was readily maintained. The author then dealt with the application of oil fuel to locomotives, and, in conclusion, said oil could be carried in spaces which it was impossible to utilize in any other way.

Oil carried in the bottom of a steamer, below the water-line, would be impervious to shot, and by the system of service tanks, patented by Sir

Fortescue Flannery, as oil was pumped out of the ballast tanks of a steamer water could readily be taken in to replace it. The importance of the new departure had been promptly recognized by Lloyds, who had issued regulations allowing liquid fuel having a flash point of over 200 degrees F. to be carried in steamers' ballast tanks, and this would greatly facilitate its general use. The speaker said that the experimental stage in the burning of liquid fuel had long since been passed. No less than 7,000,000 tons per annum were consumed in Russia for liquid fuel alone. There are no fewer than eight steamers at present engaged in the Eastern trade which were fitted for it, and the results attained had answered the expectations of their owners beyond their most sanguine anticipations, while large numbers of vessels were under construction expressly for the use of liquid fuel, and a great number of steamers hitherto burning coal were also being altered. In the Far East tanks had been erected at ports ranging from Yokohama to Suez, including all the Indian ports, while cargoes of the Borneo oil had also been landed at the principal ports, and 4000 tons was on passage to London.—*The Iron Age.*

SHIPS OF WAR.

[ENGLAND.]

AMPHITRITE.

The first-class cruiser Amphitrite, built and engined by Messrs. Vickers, Sons, and Maxim, Limited, Barrow-in-Furness, completed last week her contract trials in the English Channel. The trials are interesting from several points of view, but notably from the fact that in this vessel experiments were made for utilizing the exhaust steam from the auxiliary engines for evaporative purposes instead of using steam direct from the boilers for this object. Hitherto the exhaust steam from the host of auxiliaries has gone into the auxiliary condenser, occasioning at least two other engines before the condensed water found its way into the feed tank. This has never been a very satisfactory system of dealing with the exhaust steam, for, apart from its cost and extra weight, there was always a greater danger of leaky tubes in this condenser than in that of the main, owing to the intermittent work of the engines exhausting into it; thus salt water was always to be guarded against as coming from that quarter more than from any other. It is gratifying to find that the engineer-in-chief on the one hand and the Admiralty contractors on the other are ready and anxious to conduct steam trials and experiments with a view of arriving at the most economical method of working marine engines and boilers. It was conclusively proved by water test on the Argonaut that the consumption of the auxiliary machinery was as high as 22 per cent. of the total consumption of the main engines working at one-fifth power—about the normal power of most warships—and 10.4 per cent. at three-fourths power; it can be easily understood what a margin is left in this direction for economizing fuel. It was this difficulty of distinguishing between expenditure for propelling purposes and that of auxiliary work which has given that suspicion of empiricism to all Admiralty steam trials; but now that the correct data has been arrived at in the Argonaut, this charge can no longer be levelled at those responsible for these official trials.

It seems unfortunate that, owing to the hastily improvised fittings adopted in the Amphitrite for the utilization of the auxiliary engines' exhaust steam, after a two hours' trial the officers attending on behalf of the Admiralty consented to the abandonment of the test, but this decision was only given because they knew that similar trials on the Vindictive would be of a much more exhaustive nature; but still, so far as the new departure went, it was very satisfactory indeed. A few minor modifications will have to be made in some of the fittings, and after these are carried out, we can safely state that one of the difficulties militating against a comparatively light expenditure of coal will have been removed. The contractors are to be congratulated on the brilliant success of the trials as a whole, for not only did the engines work beautifully and without a hitch, but the economy registered, so far as coal consumption is concerned, is the lowest yet recorded where Belleville boilers, or, in fact, any other type of water-tube boiler, have been tried. The consumption averaged for the eight hours' full-power trial was 1.57 lb. of coal per I. H. P. per hour, and 1.43 lb. of coal per I. H. P. per hour for the three-fourths' power trial. This is very satisfactory, and no doubt a great deal of the success was due to the very systematic firing carried out in the boilers. Arrangements were made whereby a furnace door was not opened at more frequent intervals than six and a half minutes, and then only a minimum of coal with a maximum of distribution over the grate was indulged in. In "clinkering," too, great care was exercised to see that only portions of the fires were done at one time, so that there was not any undue cooling of the fires, and hence imperfect combustion going on. There has been a good deal to be desired in this direction in previous trials of other ships, but now that the Amphitrite has set the standard in this important detail of economy it is hoped that bad stoking will be a thing of the past.

No trouble whatever was experienced with the boilers. After the thirty hours' run at 13,500 indicated horse-power, it was found that one feed collector which extends across the front of the boiler at the bottom of the element of tubes was damaged. There being a spare feed collector on board, it was substituted for the damaged one, and this partly while the vessel was doing her gun and circle trials. We mention this merely to point out with what ease and facility the various parts of these boilers can be taken out and others substituted without the vessel being rendered powerless while the repair is going on. This in itself is one of the leading features of the Belleville boiler.

Another innovation was carried out in the working of the Amphitrite's engines, and that was, no steam jacketing whatever was used round her cylinders and slides. We are not aware whether she is so fitted, but evidently as a result of the experiments carried out in the Argonaut, Sir John Durston has arrived at the conclusion that the jacketing of cylinders is of little or no value when high boiler pressures are carried. In a recent paper read before the Institute of Naval Architects, on "Trials and Experiments in H. M. S. Argonaut," he said: "And it appears that with the comparatively low revolutions and high expansions used at 3600 indicated horse-power, the influence of the jacketing on the efficiency of the steam practically balances the expenditure of heat in the jackets. . . . At the higher power the tests appear to show that no gain in economy is obtained by steam jacketing as carried out in this vessel." Should the precedent set in the Amphitrite be universally adopted in the cylinder

arrangement of engines destined to work at high pressures, another wasteful method of using feed water, to say nothing of the multiplicity of fittings, will be abolished.

We shall be pleased to return to this subject again when the results of the Vindictive's trials are to hand, as it is one of paramount interest to all those connected with our steam navy.—*United Service Gazette.*

H.M. Torpedo Destroyer Mermaid.

Recently H.M. torpedo-boat destroyer Mermaid, which has been built and engined by Messrs. R. and W. Hawthorn, Leslie, and Co., Limited, of Newcastle-on-Tyne, completed her full-power speed trial on the measured mile off the Maplin Sands with very satisfactory results, and proved herself to be the fastest vessel of the 30-knot destroyer class yet tried.

The Mermaid is 210 ft. long by 21 ft. beam, and had a displacement of 320 tons when carrying the specified load at the commencement of the trial. The machinery consists of twin-screw, three-crank, triple-expansion engines, having cylinders 19-in., 29-in., and 46-in. by 18-in. stroke. The cranks are set at 120 deg., and balance weights are fitted upon the high-pressure and low-pressure cranks to counteract the vibratory forces. Throughout the trials the vibration was very slight, and the whole of the machinery ran without the slightest hitch. Steam is supplied by four water-tube boilers of the Thornycroft type, having a total heating surface of about 13,200 square feet, and worked at a maximum pressure of 250 lbs. per square inch.

The mean results of the six consecutive runs on the mile are as follows:

No.	Time.	Speed.	Revs. (mean).
1	2 0 5	29.901	395.2
2	1 55 0	31.304	395.5
3	1 57 8	30.562	403.9
4	1 56 2	30.986	394.2
5	1 55 0	31.304	414.7
6	1 56 4	30.928	394.8
	Mean	30.927	400.875

The general results of the three hours' trial are as follows:

Draught of water, forward	5 ft. 3½ in.	
" " aft	8 ft. 3½ in.	
Speed of ship, knots per hour, six runs	30.926	
" " three hours	30.833	
Steam pressure in boilers	225 lbs. per sq. in.	
Air pressure in stokeholds	4.96 in. of water.	
	Starboard.	Port.
Vacuum in condensers	22.8	22.1
Revolutions per minute	397.8	395.4
Mean pressure in cylinders, high	96.9	97.7
" " inter	51.3	50.8
" " low	17.8	18.0
Mean I. H. P., high	982	992
" inter	1230	1204
" low	1068	1075
Total	3270	3271
Grand total	6541	

It will be seen from the above that the high speed of 30.833 knots was obtained with a very moderate power.

The Mermaid has on all her trials been extremely successful. On her first trip to sea for the contractors' preliminary trial she obtained a mean speed of 30 knots, a performance which, it is believed, has not previously been accomplished by any vessel. On the Admiralty observation trial, before leaving the Tyne, a speed of nearly 31 knots was obtained, and upon her official consumption trial, a speed of 30.149 knots was maintained for three consecutive hours in unfavorable weather. Her full speed trial is as above described. It will thus be seen that this vessel has not once gone to sea on trial without obtaining the contract speed and maintaining it for the necessary specified time.—*The Engineer.*

GLORY.

On Saturday morning, March 11th, Her Majesty's first-class battleship Glory was floated from Messrs. Laird's shipbuilding yard at Birkenhead.

The Glory is of the Canopus class, designed by Sir William H. White, K.C.B., Director of Naval Construction, and as this class of vessel is now well known, we will offer only a short description. Her dimensions are: Length, 390 ft.; breadth, 74 ft.; mean draught about 26 ft. 6 in.; displacement, 12,900 tons; freeboard, forward, 22 ft. 6 in.; aft, 19 ft.; indicated horse-power, 13,500; speed about 18½ knots; coal stowage about 2000 tons. The armor is of Harveyed steel, and there is a protective deck from the lower edge of the armor, covering the machinery, magazines, and other vital parts.

The ship is lighted throughout with an installation of about 750 electric lights, and equipped with six search-lights of 30,000 candle-power, each of which is capable of being worked by dynamos under protection. The officers and crew are accommodated on the main and belt decks. The upper deck extends from stem to stern without a break, and above it is a continuous bridge deck extending the whole length between the barbettes; on this deck are the conning towers surmounted by navigating bridges (which will be about 36 ft. above water), and the chart-house. The masts, two in number, are built of steel, fitted with military and signalling tops, and are already in place and complete with their derricks for hoisting boats, etc.

The armament of the Glory will consist of four 12-in. 46-ton guns, mounted in barbettes, in pairs, and firing a projectile weighing 850 lbs., with a powder charge of 148 lbs. There are 43 quick-firing guns in all, twelve 6-in. on the main and upper decks, mounted in casemates protected by 6-in. armor; twelve 12-pounders, six 3-pounder quick-firing, eight small machine guns, and five field guns. There are also four submerged torpedo tubes for 18-in. torpedoes.

The main propelling machinery, constructed at the Birkenhead Iron Works, consists of two sets of engines of the triple-expansion inverted type of the latest design. Each set is placed in a separate engine-room. The cylinders are: High-pressure, 30 in.; intermediate pressure, 49 in.; and low pressure, 80 in. in diameter respectively, with a stroke of 51 in. The boilers, 20 in number, are of the Belleville type (with economizers), working at a pressure of 300 lbs., and are placed in three watertight compartments.

The Glory illustrates the advantage of building these large battleships in dock in preference to building them on a slip and launching them, as she floated out with all her citadel and casemate armor, and most of the

barbette armor in place; indeed, all the armor-plating would have been completed had it not been for the press of work in Sheffield rendering it impossible for armor-plate manufacturers to make delivery as early as required. A considerable portion of the boilers is on board. The whole of the auxiliary machinery is in place, and the pipes and connections are being fitted. The main engines are erected on board, with the exception of the cylinders, so that the vessel, as floated out from the building dock, is in a far more advanced state than would have been the case had she been launched in the ordinary way, her displacement on floating out being approximately 9000 tons. This feature is brought into prominence at the present time, as Her Majesty's ship Implacable, of 14,900 tons displacement, for which the machinery of 15,000 horse-power is also being built by Messrs. Laird Brothers, was launched from Devonport, her weight being about 4500 tons. It is expected that the Glory will be ready to hoist her pennant within six months, but the Implacable is not expected to be ready for commission for about fifteen months. The Glory will have a complement of 750 men.—*Engineering.*

IMPLACABLE.

The battleship Implacable was safely launched at Devonport, the naming ceremony being performed by Lady Ernestine Edgcumbe. This vessel is sister ship to the Formidable and the Irresistible, and her leading dimensions are as follows: Length, 400 ft.; breadth, 75 ft.; mean draught, 26.9 ft. Her displacement is 15,000 tons, and her estimated speed is 18 knots. She is the largest vessel which has ever been built at Devonport, and she has been completed in a wonderfully short space of time. She was laid down on the same slip from which the Ocean had been launched, on July 15th of last year, and since that time 5300 tons have been built into her hull. It is true that there had been a certain amount of fitting together—which dealt with some 300 tons—on an adjacent slip, but the whole of the work so fitted was taken apart and erected on the slip from which she was eventually launched. The rate of progress has therefore averaged some 150 tons a week over the eight months. Her side armor, which is 9 in. thick and 15 ft. deep, extends for a length of 216 ft. The launch was attended with all success, a very small application of hydraulic power being apparently necessary.—*The Engineer.*

SPARTIATE.

In most respects, the Spartiate, which was built at Pembroke dockyard and launched in October, 1898, is a copy of the Diadem, the typical ship of the class, her principal dimensions being the same, viz.: Length between perpendiculars, 435 ft.; beam, 69 ft.; mean draught, 26 ft.; and displacement, 11,000 tons. She is built of steel on the bracket-framed system, is double bottomed, and is without side armor; but her vital parts are protected by an armored steel deck 4 in. thick, which runs throughout her length, and is arched from 6 ft. below the water-line at the sides to 3 ft. above it on the middle line of the ship. In the way of the engines and boilers, this deck is carried upwards to the level of the engine's cylinder covers to give protection to the machinery.

The stem of the Spartiate is ram-shaped, and is materially strengthened by the protective deck being carried right up to the ram end and firmly

secured to it. The plating of her hull bottom up to above the load water-line is also sheathed with teak 4 in. thick, and covered with sheet copper; bilge keels, 3 ft. 6 in. deep, being also fitted on both her sides. She will be steered by a balanced rudder, actuated by steering engines in duplicate of Messrs. Bow and McLachlan and Co.'s make, the controlling gear being on Messrs. Brown's telemotor principle; five of these gears being fitted for controlling the helm, from as many different stations in the ship. She will have four funnels; and two masts for signalling purposes, these having, however, no fighting tops.

The armament of the Spartiate will consist of sixteen 6-in. and fourteen 12-pounder quick-firing guns, and several smaller pieces, together with three torpedo tubes. Twelve of the 6-in. guns will be mounted in casemates on the broadsides, two will be carried on the forecastle, and two on the poop behind shields, while two of the torpedo tubes will be on the broadsides forward, submerged; and the third one right aft amidships, above the water-line.

The 18,000 indicated horse-power to be developed by the Spartiate's engines, as compared with 16,500 by the Diadem's, is not obtained by any increase in their size, or in the number of her boilers, but by giving the latter a much larger amount of heating surface, and, therefore, an increase of evaporative efficiency. The coal bunker capacity at the ship's normal load draught is 1000 tons, but provision is made for carrying an extra 900 tons if required.—*The Engineer.*

[FRANCE.]

SUFFREN.

Figaro says: "The cruiser Suffren, of 12,504 tons, the construction of which was begun on January 5 last, will be launched on July 25. Thus only six months and twenty days will have elapsed from the time she was laid down until the launch. This is the first occasion on which a vessel of this importance has been built in so short a time. The rapidity of construction of British warships which has been so often cited as an example, and which has already been beaten in the case of the Jena, constructed in 7½ months, is completely distanced by the Suffren. Eight hundred workmen have been constantly employed on the huge hull." It should be pointed out, says the *Times*, in quoting the *Figaro*, that the message does not supply sufficient information to justify the conclusions drawn from the facts stated. A ship may be launched at various stages in her construction, but she cannot properly be said to have been "built" in the sense used here until she is completed for sea. The Jena was not completed for sea in 7½ months. No French vessel has reached the British standard in this respect.—*Engineering.*

[ITALY.]

LIGURIA.

The Liguria is a well-known type of Italian vessel, a sort of small Esmeralda, with a pair of 6-in. guns fore and aft instead of a single big gun. The rest of the armament is six 4.7-in. quick-firers, and four 12-pounders, recently added, two forward and two aft on the main deck. Elswick vessels are often spoken of as being typically over-gunned; but this Liguria, though of half the tonnage and two-thirds the length of the

AVERAGE WEIGHTS OF MACHINERY AND HEATING SURFACES; "DIADEM" AND "ARGONAUT" CLASSES.

Class.	Description of Trial.	Trial.								Weights.		Surfaces.		I. H. P. per Ton (Mean I. H. P.)		Weight in Pounds per I. H. P. (Mean I. H. P.)			I. H. P. per Square Foot of Grate (Mean I. H. P.)	Heating Surface per I. H. P. (Mean I. H. P.)
		Duration.	Revolutions.	Piston Speed.	Steam Pressure. Boilers.	Steam Pressure. Engines.	I. H. P. Developed (Mean).	Air Pressure.	Coal per I. H. P. per Hour.	Machinery Complete.	Boilers Complete.	Grate.	Heating.	Machinery Complete.	Boilers.	Engines.	Boilers.	Total.		
		hrs										sq. ft.	sq. ft.							
Diadem ...	3,300 I. H. P....	30	67.9	543.8	218.5	160.5	3,339	....	2.04	1540	767	1460	40,990	8.30	16.66	135	135	270	8.75	3.20
	12,500 I. H. P....	30	106.5	852.0	267.0	230.0	12,785	....	1.71			1400	40,990	11.01	22.11	109	101	204	11.60	2.41
	Full power ...	8	116.6	933.2	286.5	236.7	16,961	....	1.73											
Argonaut.	3,600 I. H. P....	30	73.1	584.8	238.0	138.0	3,784	....	2.03	1578	787	1300	47,300	8.89	17.70	127	127	254	10.02	3.39
	13,500 I. H. P....	30	112.6	901.0	260.0	220.0	13,932	....	1.66			1300	47,300	12.05	24.17	93	92	185	13.69	2.49
	Full power ...	8	123.6	989.0	291.0	257.0	19,025	.2	1.64											

Hai-Tien, carries four 6-in. as against two 8-in., and six 4.7-in. against ten of the same caliber. She certainly does give the impression of being over-gunned, her decks are very cramped; while the two huge funnels and the superstructure about them give an idea of top-heaviness. She once carried heavy military tops, but these have been removed, and small platforms for machine guns, not very high up, have been substituted.—*The Engineer.*

[JAPAN.]

KASAGI.

The Japanese protected cruiser Kasagi was built at Philadelphia and armed at Elswick. She has an armored steel deck, 2 in. thick over the flat, and 4½ in. over the slopes, and she is of the following dimensions: Length between perpendiculars, 396 ft.; beam, 49 ft.; draught, 17 ft. 7 in.; displacement, 4760 tons; indicated horse-power, 15,500; 22½ knots' speed; two propellers; and she has cost £205,200. Her armament comprises two 8-in. quick-firing guns, ten 4.7-in. quick-firing guns; twelve quick-fire 12-pounders, and four 2½-pounder quick-firing Japanese guns in the tops. She carries five torpedo tubes, all above water, one of which is at the bows of the vessel, and twenty-five torpedoes are contained in the torpedo racks on board, as the unit for ordinary service. The bodies of these torpedoes are carried in cases or racks of steel wire netting, which is an excellent arrangement, and preserves the rudders and propellers from all possibility of accident. The extreme coal capacity of the bunkers of the Kasagi is 1020 tons. She had, however, only about 550 tons on board when we visited her, 450 tons of which had been taken in the day before in nine hours. She was fairly "light" in the water, and her full weights, except a portion of the crew, were on board. It is assumed, therefore, that her coal capacity, at normal draught, would be about 600 tons. This is good for so small a vessel.

One distinguishing feature in the Kasagi is the absence of wood everywhere; decks—excepting the upper ones—partitions of cabins, sides and treads of companion ladders, ceilings of cabins, and nearly all other features which in ships have been immemorially constructed of wood, are here found to be of steel or some other metal. The captain's saloons are ceiled with embossed steel, excessively thin and yielding to the pressure of the hand. The stamped and embossed ornaments give these apartments a very elegant appearance. The spokes and rims of the steering wheels are all of gun-metal. The men's mess tables are about the only articles which are made of wood, but the seats upon which the men sit at meals are sheet-steel boxes, with steel lids, in which their kits—mess gear, etc., etc.—are kept. To prevent discomfort, each man is allowed a little loose board to place upon the top of his box-seat. These would be heaved overboard in action. In the officers' lavatories there are capital enamelled baths, wash-stands, and other articles, but all are of metal, not a scrap of wood being observable anywhere.

The artificers' workshop is very complete, and three good-sized lathes, together with drilling machines, and other machinery, all worked by steam, are fitted; but we observed everywhere an absence of spare parts and stores. The conning tower of the Kasagi is differently constructed from those on board British war vessels. The top, instead of being removable, so as to afford a look-out all round, is attached to the sides, and horizontal slits only are left for taking observations. This is pos-

sibly a wise arrangement, for there is always a chance of the cover of our conning towers being lifted off by a blow from a large projectile. There appeared to be no voice-tube exchange stations on board. Mouthpieces of tubes, extending to almost every position, are fixed within the conning tower itself. The arrangement of anchors is curious, two being on beds upon the port side and one upon the starboard, *vice versa* to the plan on board our vessels.

The armament of the Kasagi is her remarkable feature. Whichever way we look at the question, it certainly appears an anomaly that our Niobe, of 11,000 tons displacement, should carry no weapon of even approximately equivalent potency to the 8-in. quick-firer of the Japanese cruiser of 4760 tons—assuming that the latter has been judiciously armed, which, however, is begging the whole question. The 8-in. guns, two in number, are mounted fore and aft upon the forecastle and poop, within very large and roomy steel hoods, 4½ in. thick. They are capable of containing, each, almost a whole gun's crew of the medium-sized wiry Japanese bluejackets. In rear of each gun position is the circular mouth of an armored hoist leading down to the magazines. It projects slightly out of the deck, and has a semi-spherical solid steel cap to cover it, which opens and shuts. When open the ammunition hoist is seen, which works on endless chains over a roller at the top, and runs out the cartridges—in cylinders—and projectiles, on to a loading tray. A small gun-metal tramway on the deck runs past the hoist, and from each extremity of the gun's possible arc of training. It has trolleys on it for conveying the projectiles to the various loading positions, and the lines have loops for the full and empty trolleys to pass one another.

The 8-in. gun fires an armor-piercing shot of 250 lbs., and a common shell of 220 lbs., so that the tramways and trolleys are a necessity. The gun weighs 18 tons, and the mounting 11 tons, so that the whole revolving weight is 30 tons.

The 4.7-in. quick-firing guns, which are on either broadside, have also good-sized steel shields 4½ in. thick, and are sponsoned out, so that the forward and aft pairs can point directly ahead or astern, according to their position in the ship, with an arc of training of 130 deg., whilst those between have an arc of 100 deg. of training. Of course the shields thin off towards the rear. The forward pair is casemated. Armored tubes protect the ammunition *en route* from the magazines, and a hatch, covered with an armored circular cap, somewhat similar to that employed for the 8-in. guns, surmounts the hoist for ammunition and projectiles. We should have mentioned that all the ammunition hoists are worked by electric motors, which actuate an endless chain at the side.

The 12-pounder guns have lighter shields, and they occupy intermediate positions between the 4.7-in. quick-firers, with the exception of the forward and after pair, which are within casemates of stout steel plating beneath the forecastle and within the captain's saloon respectively. The ammunition for the 12-pounders is also brought up by an electric hoist, through an armored tube, and opens by a large hatchway into a small, armor-protected square deck-house beneath the poop deck. This is an excellent arrangement for protecting the 12-pounder ammunition until it arrives on deck, and from thence it is served to the guns.

Four 2½-pounder Japanese quick-firers are in the tops. These are similar to the guns of the Takasago, already described in the columns of

The Engineer. They have large shields of a different shape from those employed in British tops, but somewhat similar to those of the broadside 12-pounders, only smaller and lighter, of course.

The unit of ammunition carried for the guns of this vessel on ordinary service is as follows: 100 rounds for each 8-in. gun, 200 rounds for each 4.7-in. gun, 300 rounds for each 12-pounder, and 400 rounds for each 2½-pounder. These units are doubled when the ship is despatched on war service. We were told that the whole of this quantity of ammunition could be carried in the magazines, but it is possible that the question may not have been fully understood. It appears a very extraordinary amount to maintain in the magazines, even in the eventualities of war.

The totals of the weights of ordinary ammunition would be as follows:

Two 8-in. quick-firing guns, 200 projectiles, say	50,000 lbs.	262,800 lbs.
Charges with metal cylinders, say	15,000 lbs.	
Ten 4.7-in. quick-firing guns, 2000 projectiles, say	90,000 lbs.	
Charges with metal cylinders, say	40,600 lbs.	
Twelve 12-pounder guns, 3600 projectiles, say	43,200 lbs.	
Charges with metal cylinders, say	18,000 lbs.	
Four 2½-pounder guns, 1600 projectiles, with charges, say	6,000 lbs.	

Or, roughly, with blank and saluting ammunition, about 120 or 130 tons. And on active service this quantity would be doubled.

The mounting and shields of the 8-in. quick-firers are rotated by electric motors, and it is said that the whole of the arc of 270 deg. could be passed over easily in one minute. Elevation is also accomplished by a small motor. These movements can, however, be carried into effect by hand and hand-gear wheels, which worked with the utmost ease and smoothness, and were in action during the occasion of our visit. The opening and closing of the breech was effected by a hand wheel between the breech and trunnion axis; four rounds can be fired in 64 seconds.

The appearance of the Kasagi did not impress us favorably. The large projecting sponsons, two heavy guns and mountings fore and aft, weighing each over 30 tons, gave us the impression of far too much topweight. Perched, as the latter were, upon the poop and forecastle, with 30 tons weight so close to the stem, and three anchors besides, to say nothing of chain cables, etc., we should say that the Kasagi would plunge and make very bad weather in a heavy sea. And the proximity of the broadside guns to one another is so remarkable that there would be hardly room to work them. It certainly does seem singular that a vessel only 400 tons superior in displacement to the Fox can carry an armament so immensely superior in weight of metal and in actual numbers, the following being a comparative statement:

FOX.		KASAGI.	
Two	6-in. quick-firers	Two	8-in. quick-firers.
Eight	4.7-in. "	Ten	4.7-in. "
Eight	6-pr. "	Twelve	12-pr. "
One	3-pr. "	Four	2½-pr. "

This, too, is independent of the question of coal capacity and engine power. The Japanese cruiser is better off by 50 per cent. as regards the first item. As regards the second, there is a difference of no less than three knots in favor of the Kasagi.

Wherein, then, do these vessels differ? We believe that a solution might be found by examining the framing, scantling, double bottom, and,

more than all, the skin plating of the new ships. Sir W. H. White puts down the following percentages of the whole displacement as distributed over the weights of a fast protected cruiser of this type: Hull, 38; propelling machinery and coals, 35; protective material, 16; armament and equipment, 11. But he had not in view engines and boilers working up to 15,500 indicated horse-power for a vessel of 4760 tons, or coal bunker capacity of 1000 tons, or armament and equipment, which must absorb at least 15 or 16 per cent. of the whole. Yet it is clear that if all these extraordinary weights are present, the percentage of 38 for the hull must have been seriously discounted in the designing of the Kasagi. We merely offer this as a possible solution of the enigma—for an enigma it certainly is.—*The Engineer.*

TOKIWA.

During the past week the steam trials of the Tokiwa, the second Japanese belted cruiser of 7900 tons, have been completed at the mouth of the Tyne. Her particulars are the same as those of the Asama, recently given by us, and need not be repeated now; but, shortly, she is a vessel 408 ft. long, armored with a 7-in. belt, and carries four 8-in. guns, fourteen 6-in. guns, and a number of smaller guns, and five torpedo tubes. Nearly the whole of the guns have strong armor protection, and four of the torpedo tubes are below the water-line. At her speed trials runs were made at 10, 15.6, 18.8, 21.2, and 22.73 knots, and during six hours the vessel ran at a mean speed of 20.85 knots with open stokeholds. At her last trial she ran for three hours with a pressure in her stokeholds scarcely exceeding 1½ in. at a mean speed of 23.1 knots. The engines have been supplied by Messrs. Humphrys, Tennant, and Co., and she has twelve single-ended cylindrical boilers.

AKEBONO.

A very successful official trial of the torpedo-boat destroyer Akebono (Dawn), built for the Imperial Japanese Navy by Messrs. Yarrow and Co., Limited, was made on March the 4th, at the mouth of the Thames. This vessel is one of six, the contract for which the Japanese Admiralty placed with Messrs. Yarrow and Co., Limited. The leading dimensions are as follows: Length, 220 ft.; beam, 20 ft. 6 in.; displacement, fully coaled and armed, about 420 tons. The model is similar to that of the Sokol, which the same firm built a few years since for the Russian Navy, but the dimensions are considerably enlarged. The type has now become one of the leading classes in the Russian Navy. The armament consists of two 18-in. swivel torpedo tubes, one 12-pounder and five 6-pounder quick-firing guns. The steam is generated by four large water-tube boilers of the Yarrow patent straight water-tube type, each with its own funnel. The propelling machinery consists of twin-screw engines of the four-cylinder four-crank triple-expansion type, capable of indicating up to 6500 horse-power with 200 lbs. pressure. The speed guaranteed by the vendors on a three-hours' continuous run, carrying a load of 35 tons, was 31 knots. Three vessels have already passed their official trials, and the contract speed has been easily obtained. When the Japanese Government have the three additional destroyers not yet tried, which are being built at Poplar, they will have a group of torpedo-boat destroyers of higher speed than any other government in the world. The details of the trials are as follows: The draught of water forward was

5 ft. and aft 8 ft. 1 in., the load carried being 35 tons. The Japanese Government was represented by Commander-Constructor M. Kondo and Constructor-Captain H. Kurobe. Six runs were made over the measured mile on the Maplin, the following being the particulars:

Number of Run.	Boiler Steam.*	Vacuum.	Air Pressure in Stokehold.	Mean Revolutions per Minute.	Time.	Speed.	Mean Speed.	Second Mean Speed.	
	lbs.	in.	in.		m. s.				
1	226	24½	1½	432	1 51	32.432			
2	226	24½	1½	434½	2 0½	29.875	31.154	31.117	
3	226	24½	1½	434½	1 51½	32.286	31.080	31.143	31.159 knots
4	226	24½	1½	436½	1 59½	30.125	31.206	31.184	
5	226	24½	1½	436½	1 51½	32.200	31.162	31.194	
6	226	24½	1½	439½	1 59	30.252	31.226		

*Throttled.

Based on the revolutions necessary to make a knot, the mean speed during the three hours' continuous run was found to be 31.08 knots. The machinery throughout gave no trouble, and there was no flame visible at the funnels at any time. The weather was rather rough and a northeast wind made the sea off the North Foreland lumpy. This vessel was launched nine days prior to the official trial, and had only one preliminary run before the trial took place.—*Engineering.*

Shiranui.

The fourth Japanese torpedo-boat destroyer, Shiranui (Will o' the Wisp), recently launched from the yard of Messrs. John I. Thorneycroft and Co., Chiswick, underwent a satisfactory full-speed trial at the Maplin Sands on the 30th ult. The contractors guaranteed a speed of 30 knots when carrying a load of 35 tons, and the results obtained on the trial were 30.443 knots on the measured mile and 30.517 knots during three hours' continuous steaming.—*Engineering.*

[Russia.]

Gromboy.

The new first-class cruiser and a transport were launched on the Neva from the Baltic shipbuilding yard in presence of the Emperor, the Empress-Dowager, and other members of the Imperial family. The new armored cruiser, called the Gromboy, resembles in the main the great cruiser, the Rossia, launched from the same yard in 1896. The principal details of the vessel are: Length, 480 ft.; breadth, 69 ft.; load displacement, 12,539 tons; with engines of 14,500 horse-power. The transport ship, the Yenisei, measures 300 ft. in length and 39 ft. in breadth, with a displacement of 2600 tons, and the engines 4700 horse-power.—*Engineering.*

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